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# Bathyal and Abyssal Myodocopid Ostracoda of the Bay of Biscay and Vicinity

LOUIS S. KORNICKER

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SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 467

# Bathyal and Abyssal Myodocopid Ostracoda of the Bay of Biscay and Vicinity

*Louis S. Kornicker*

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## ABSTRACT

Kornicker, Louis S. Bathyal and Abyssal Myodocopid Ostracoda of the Bay of Biscay and Vicinity. *Smithsonian Contributions to Zoology*, number 467, 134 pages, 73 figures, 8 tables, 1989.—Twenty one species (16 new) in 12 genera (2 new) in 3 families of myodocopid Ostracoda collected mostly at bathyal and abyssal depths in the Bay of Biscay and the eastern end of the West European Basin during 13 cruises (1969–1983) by personnel of the Centre National de Tri d'Océanographie Biologique (CENTOB), France, are described and illustrated. Seventeen species are reported from abyssal depths (below 2000 m), and 13 species are reported from bathyal depths (200–2000 m). All benthic species collected below 3480 m were blind, which is close to the depth of 3775 m previously reported for species in southern oceans (Kornicker, 1975a:48). Specimens collected extend northward the known ranges of the genera: *Hadacypridina* Paulson, 1962, *Metavargula* Kornicker, 1970, and *Paradoloria* Hanai, 1974.

Three species not included in the study area are presented in the text for purposes of comparison.



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# Bathyal and Abyssal Myodocopid Ostracoda of the Bay of Biscay and Vicinity

*Louis S. Kornicker*

## Introduction

This work reports on the Ostracoda in the suborder Myodocopina collected in a series of deep-sea expeditions conducted by the Centre National de Tri d'Oceanographie Biologique (CENTOB), France, to the eastern end of the West European Basin including the Bay of Biscay (Golfe de Gascogne) from 1969–1983. A preliminary note in which the ostracodes were mostly identified only to genus was published previously as part of a comprehensive report on the expeditions (Kornicker, in Laubier and Monnoit, 1985:409). The identifications given in that note have been listed in the synonomies of species described herein in order to relate the two papers.

STATIONS.—The localities of stations are presented in "Station Data with Specimens Examined" in which the expeditions, as well as the samples collected during each expedition, are listed chronologically. In Table 1, as well as in each species description in the text, the number of specimens of that species in the samples are given for each station listed in numerical order. The samples were collected mainly from 6 stations (designated herein as BIOGAS stations after the name of the series of expeditions on which the samples were collected): numbers 1–4 in the eastern end of the West European Basin and west of the northern half of the Bay of Biscay, and numbers 5 and 6 from the southern part of the bay (Figure 1). The samples collected from each station were not always from precisely the same spot so that the depths, sediments, and other conditions varied among samples from the same station. Characteristics of the substrate and water at each station, as well as the fauna and flora collected there, are given in the 1985 report edited by Laubier and Monnoit. The depth range of samples at each station from which myodocopids were collected is as follows: station 1 (38 samples), 1970–2360 m; station 2 (20 samples), 2695–3742 m: station 3 (4 samples), 4125–4240 m; station 4 (7 samples), 4550–4825 m; station 5 (5 samples), 4203–4475 m; station 6 (13 samples), 1845–2430 m. Most samples (71) were collected shallower than 4000 m, and relatively few (16) deeper than 4000 m.

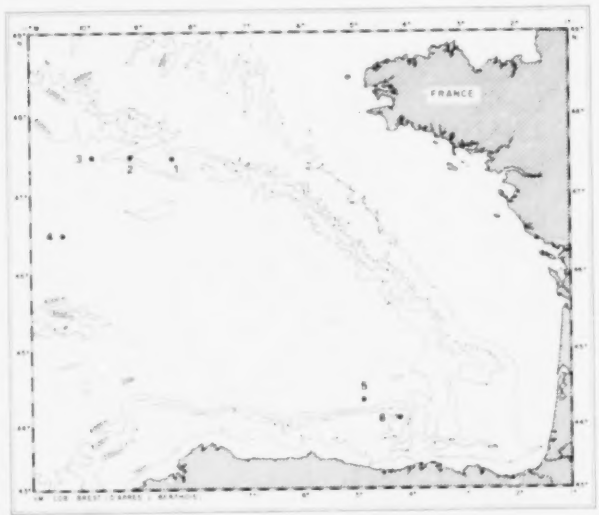


FIGURE 1.—Bay of Biscay showing location of stations 1–6. (From Laubier and Monniot, editors, 1985).

In addition, 8 samples with ostracodes were collected from stations designated "Hors-Zone," which is a term used for a sample taken too far from the BIOGAS stations to be assigned to one of the stations, and where the bottom may be very different from that at the closest BIOGAS station; they were samples taken especially at the beginning of the program to better delimit the BIOGAS stations. Three additonal stations designated "Grand Vasiere" were collected on the continental

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TABLE 1.—Number of specimens of each species in sample.

| Station and Sample Number | Depth m | *Azygocypridina imperialis* | *Paradoloria lippa* | *Paradoloria magna* | *Metavargula quintuplex* | *Metavargula hex* | *Metavargula bilix* | *Rheina prex* | *Radacypridina biscayensis* | *Gigantocypris muelleri* | *Philomedes pentathrix* | *Philomedes lilljeborgii* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Station 1** | | | | | | | | | | | | |
| DS-11 | 2205 | - | - | - | 5 | - | - | - | - | - | 1 | - |
| DS-12 | 2180 | - | - | - | 1 | - | - | - | - | - | 2 | - |
| DS-13 | 2165 | 1 | - | - | 10 | - | - | - | - | - | 31 | - |
| DS-15 | 2246 | 1 | - | - | 129 | - | - | - | - | - | 290 | - |
| DS-17 | 2103 | - | - | - | 18 | - | - | - | - | - | 384 | - |
| DS-32 | 2138 | - | - | - | 26 | - | - | - | - | - | 1 | - |
| DS-35 | 2226 | - | - | - | 9 | - | - | - | - | - | 14 | - |
| DS-36 | 2147 | - | 238 | 1 | - | - | 4 | - | - | - | - | 82 |
| DS-37 | 2110 | - | - | - | 35 | - | - | - | - | - | - | - |
| DS-38 | 2138 | - | - | - | 15 | - | - | - | - | - | 1 | - |
| DS-61 | 2250 | - | - | - | 4 | - | - | - | - | - | 44 | - |
| DS-62 | 2175 | - | - | - | 39 | - | - | - | - | - | 11 | - |
| DS-63 | 2126 | 1 | - | - | 84 | - | - | - | - | - | 2 | - |
| DS-64 | 2156 | - | - | - | 21 | - | - | - | - | - | - | - |
| DS-65 | 2360 | - | - | - | - | - | - | - | - | - | - | - |
| DS-71 | 2194 | - | - | - | 40 | - | - | - | - | - | 1 | - |
| KR-37 | 2205 | - | - | - | - | - | - | - | - | - | 1 | - |
| CP-01 | 2245 | - | - | - | 1 | - | - | - | - | - | - | - |
| CP-02 | 2177 | - | - | - | - | - | - | - | - | 1 | - | - |
| CP-08 | 2177 | - | - | - | 3 | - | - | - | - | - | 3 | - |
| CP-08a | 2177 | - | - | - | 5 | - | - | - | - | - | 1 | - |
| CP-09 | 2171 | - | - | - | 3 | - | - | - | - | - | 51 | - |
| CP-09A | 2171 | - | - | - | 5 | - | - | - | - | - | 64 | - |
| CP-32 | 2170 | - | - | - | - | - | - | - | - | 2 | - | - |
| CP-33 | 2115 | - | - | - | - | - | - | - | - | 2 | - | - |
| CP-34 | 1970 | - | - | - | 12 | - | - | - | - | 1 | - | - |
| CP-37 | 2175 | - | - | - | 7 | - | - | - | - | - | 3 | - |
| KG-144 | 2225 | - | - | - | - | - | - | - | - | - | 1 | - |
| KG-145 | 2170 | - | - | - | - | - | - | - | - | - | 1 | - |
| KG-147 | 2190 | - | - | - | - | - | - | - | - | - | - | - |
| KG-148 | 2170 | - | - | - | 3 | - | - | - | - | - | 4 | - |
| KG-149 | 2165 | - | - | - | - | - | - | - | - | - | 1 | - |
| KG-151 | 2205 | 1 | - | - | - | - | - | - | - | - | - | - |
| KG-156 | 2207 | - | - | - | - | - | - | - | - | - | 2 | - |
| KG-157 | 2227 | - | - | - | - | - | - | - | - | - | 4 | - |
| KG-158 | 2167 | - | - | - | 1 | - | - | - | - | - | 1 | - |
| PL-18 | 2000 | - | - | - | 1 | - | - | - | - | - | - | - |
| PL-22 | 2000 | - | - | - | 1 | - | - | - | - | - | - | - |

TABLE 1.—Continued.

| Station and Sample Number | Depth m | *Tetragonodon pellax* | *Domomeus heptathrix* | *Parasterope antyx* | *Parasterope styx* | *Synasterope hirpex* | *Synasterope helix* | *Synasterope phalanx* | *Synasterope index* | *Prionotoleberis rex* | *Prionotoleberis pax* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Station 1** | | | | | | | | | | | |
| DS-11 | 2205 | - | - | - | - | - | - | - | - | - | - |
| DS-12 | 2180 | - | - | - | - | - | - | - | - | - | - |
| DS-13 | 2165 | - | - | - | - | - | 1 | - | - | - | - |
| DS-15 | 2246 | - | 8 | - | - | - | - | - | - | - | - |
| DS-17 | 2103 | - | 2 | - | - | - | - | - | - | - | - |
| DS-32 | 2138 | - | 1 | - | - | - | - | - | - | - | - |
| DS-35 | 2226 | - | - | - | - | - | - | - | - | - | - |
| DS-36 | 2147 | - | - | - | - | - | - | 3 | - | - | - |
| DS-37 | 2110 | - | 1 | - | - | - | - | - | - | - | - |
| DS-38 | 2138 | - | - | - | - | - | - | - | - | - | - |
| DS-61 | 2250 | - | - | - | - | - | - | - | - | - | - |
| DS-62 | 2175 | - | - | - | - | - | - | - | - | - | - |
| DS-63 | 2126 | - | 1 | - | - | - | - | - | - | - | - |
| DS-64 | 2156 | - | - | - | - | - | - | - | - | - | - |
| DS-65 | 2360 | - | 1 | - | - | - | - | - | - | - | - |
| DS-71 | 2194 | - | - | - | - | - | - | - | - | - | - |
| KR-37 | 2205 | - | - | - | - | - | - | - | - | - | - |
| CP-01 | 2245 | - | - | - | - | - | - | - | - | - | - |
| CP-02 | 2177 | - | - | - | - | - | - | - | - | - | - |
| CP-08 | 2177 | - | - | - | - | - | - | - | - | - | - |
| CP-08a | 2177 | - | - | - | - | - | - | - | - | - | - |
| CP-09 | 2171 | - | - | - | - | - | - | - | - | - | - |
| CP-09A | 2171 | - | - | - | - | - | - | - | - | - | - |
| CP-32 | 2170 | - | - | - | - | - | - | - | - | - | - |
| CP-33 | 2115 | - | - | - | - | - | - | - | - | - | - |
| CP-34 | 1970 | - | - | - | - | - | - | - | - | - | - |
| CP-37 | 2175 | - | - | - | - | - | - | - | - | - | - |
| KG-144 | 2225 | - | - | - | - | - | - | - | - | - | - |
| KG-145 | 2170 | - | - | - | - | - | - | - | - | - | - |
| KG-147 | 2190 | - | 1 | - | - | - | - | - | - | - | - |
| KG-148 | 2170 | - | - | - | - | - | - | - | - | - | - |
| KG-149 | 2165 | - | - | - | - | - | - | - | - | - | - |
| KG-151 | 2205 | - | - | - | - | - | - | - | - | - | - |
| KG-156 | 2207 | - | - | - | - | - | - | - | - | - | - |
| KG-157 | 2227 | - | - | - | - | - | - | - | - | - | - |
| KG-158 | 2167 | - | - | - | - | - | - | - | - | - | - |
| PL-18 | 2000 | - | - | - | - | - | - | - | - | - | - |
| PL-22 | 2000 | - | 1 | - | - | - | - | - | - | - | - |

TABLE 1.—Continued.

| Station and Sample Number | Depth m | *Azygocypridina imperialis* | *Paradoloria lippa* | *Paradoloria magna* | *Metavargula quintuplex* | *Metavargula hex* | *Metavargula bilix* | *Rheina prex* | *Badacypridina biscayensis* | *Gigantocypris muelleri* | *Philomedes pentathrix* | *Philomedes lilljeborgii* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Station 2** | | | | | | | | | | | | |
| DS-31 | 2813 | 15 | - | - | 1 | - | - | - | - | - | 17 | - |
| DS-41 | 3548 | - | - | - | 6 | - | - | - | - | - | - | - |
| DS-57 | 2906 | 1 | - | - | - | - | - | - | - | - | - | - |
| DS-59 | 2790 | 2 | - | - | - | - | - | - | - | - | 2 | - |
| DS-60 | 3742 | - | - | - | 2 | - | - | - | 1 | - | - | - |
| DS-66 | 3480 | - | - | - | - | - | - | - | - | - | 2 | - |
| DS-73 | 2805 | - | - | - | 1 | - | - | - | - | 1 | - | - |
| DS-74 | 2777 | 2 | - | - | - | - | - | - | - | - | 1 | - |
| DS-75 | 3250 | - | - | - | 1 | - | - | - | 1 | - | - | - |
| NA-04 | 2700 | 2 | - | - | - | - | - | - | - | - | - | - |
| NA-20 | 2700 | 1 | - | - | - | - | - | - | - | - | - | - |
| CV-38 | 2695 | 1 | - | - | - | - | - | - | - | - | - | - |
| CP-12 | 2925 | - | - | - | - | - | - | - | - | 1 | - | - |
| CP-28 | 3380 | - | - | - | - | - | - | - | - | 1 | - | - |
| KG-172 | 2820 | 1 | - | - | - | - | - | - | - | - | - | - |
| KG-173 | 2740 | 1 | - | - | - | - | - | - | - | - | - | - |
| KG-176 | 2807 | 1 | - | - | - | - | - | - | - | - | - | - |
| KG-178 | 2770 | 2 | - | - | - | - | - | - | - | - | - | - |
| KG-180 | 2847 | - | - | - | - | - | - | - | - | - | 1? | - |
| KG-185 | 2828 | 1 | - | - | - | - | - | - | - | - | - | - |
| **Station 3** | | | | | | | | | | | | |
| DS-55 | 4125 | - | - | - | - | - | - | 1 | - | - | - | - |
| DS-76 | 4228 | - | - | - | - | - | - | 6 | - | - | - | - |
| DS-77 | 4240 | - | - | - | - | 3 | - | - | - | - | - | - |
| CP-13 | 4134 | - | - | - | - | - | - | - | - | 2 | - | - |
| **Station 4** | | | | | | | | | | | | |
| DS-68 | 4550 | - | - | - | - | - | - | - | 1 | - | - | - |
| DS-78 | 4706 | - | - | - | - | - | - | - | - | - | - | - |
| DS-79 | 4715 | - | - | - | - | - | - | 1 | - | 1 | - | - |
| CP-15 | 4715 | - | - | - | - | - | - | - | - | 1 | - | - |
| CP-16a | 4825 | - | - | - | - | - | - | 1 | - | - | - | - |
| CP-17 | 4706 | - | - | - | - | - | - | - | - | 2 | - | - |
| CP-18 | 4721 | - | - | - | - | - | - | - | - | 1 | - | - |

TABLE 1.—Continued.

| Station and Sample Number | Depth m | *Tetragonodon pellax* | *Domromeus heptathrix* | *Parasterope antyx* | *Parasterope styx* | *Synasterope hirpex* | *Synasterope helix* | *Synasterope phalanx* | *Synasterope index* | *Prionotoleberis rex* | *Prionotoleberis pax* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Station 2** | | | | | | | | | | | |
| DS-31 | 2813 | - | - | - | - | - | - | - | - | - | - |
| DS-41 | 3548 | - | - | - | 2 | - | - | - | - | - | - |
| DS-57 | 2906 | - | - | - | - | - | - | - | 1 | - | - |
| DS-59 | 2790 | - | - | - | - | - | - | - | - | - | - |
| DS-60 | 3742 | - | - | - | 2 | - | - | - | - | - | - |
| DS-66 | 3480 | - | - | - | 1 | - | - | - | - | - | - |
| DS-73 | 2805 | - | - | - | - | - | - | - | - | - | - |
| DS-74 | 2777 | - | - | - | - | - | - | - | - | - | - |
| DS-75 | 3250 | - | - | - | 1 | - | - | - | - | - | - |
| NA-04 | 2700 | - | - | - | - | - | - | - | - | - | - |
| NA-20 | 2700 | - | - | - | - | - | - | - | - | - | - |
| CV-38 | 2695 | - | - | - | - | - | - | - | - | - | - |
| CP-12 | 2925 | - | - | - | - | - | - | - | - | - | - |
| CP-28 | 3380 | - | - | - | - | - | - | - | - | - | - |
| KG-172 | 2820 | - | - | - | - | - | - | - | - | - | - |
| KG-173 | 2740 | - | - | - | - | - | - | - | - | - | - |
| KG-176 | 2807 | - | - | - | - | - | - | - | - | - | - |
| KG-178 | 2770 | - | - | - | - | - | - | - | - | - | - |
| KG-180 | 2847 | - | - | - | - | - | - | - | - | - | - |
| KG-185 | 2828 | - | - | - | - | - | - | - | - | - | - |
| **Station 3** | | | | | | | | | | | |
| DS-55 | 4125 | - | - | - | - | 1 | - | - | - | - | - |
| DS-76 | 4228 | - | - | - | - | - | - | - | - | - | - |
| DS-77 | 4240 | - | - | - | - | - | - | - | - | - | - |
| CP-13 | 4134 | - | - | - | - | - | - | - | - | - | - |
| **Station 4** | | | | | | | | | | | |
| DS-68 | 4550 | - | - | - | - | 1 | - | - | - | - | - |
| DS-78 | 4706 | - | - | - | - | 2 | - | - | - | - | - |
| DS-79 | 4715 | - | - | - | - | 1 | - | - | - | - | - |
| CP-15 | 4715 | - | - | - | - | - | - | - | - | - | - |
| CP-16a | 4825 | - | - | - | - | - | - | - | - | - | - |
| CP-17 | 4706 | - | - | - | - | - | - | - | - | - | - |
| CP-18 | 4721 | - | - | - | - | - | - | - | - | - | - |

TABLE 1.—Continued.

| Station and Sample Number | Depth m | *Azygocypridina imperialis* | *Paradoloria lippa* | *Paradoloria magna* | *Metavargula quintupler* | *Metavargula hex* | *Metavargula bilix* | *Rheina prex* | *Hadacypridina biscayensis* | *Gigantocypris mielleri* | *Philomedes pentathrix* | *Philomedes lilljeborgii* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Station 5** | | | | | | | | | | | | |
| DS-48 | 4203 | - | - | - | - | 1 | - | - | - | - | - | - |
| DS-53 | 4425 | - | - | - | - | - | - | 2 | - | - | - | - |
| CP-21 | 4453 | - | - | - | - | - | - | - | - | 1 | - | - |
| CP-21a | 4453 | - | - | - | - | - | - | - | - | 1 | - | - |
| CP-22 | 4475 | - | - | - | - | - | - | - | - | 1 | - | - |
| **Station 6** | | | | | | | | | | | | |
| DS-25 | 2096 | 1 | - | - | 1 | - | - | - | - | - | - | - |
| DS-26 | 2076 | 1 | - | - | 40 | - | - | - | - | - | - | - |
| DS-49 | 1845 | - | - | - | 8 | - | - | - | - | - | - | - |
| DS-50 | 2124 | 1 | - | - | 62 | - | - | - | - | - | - | - |
| DS-51 | 2430 | 3 | - | - | - | - | - | - | - | - | - | - |
| DS-52 | 2006 | 1 | - | - | 168 | - | - | - | - | - | 1 | - |
| DS-87 | 1913 | 3 | - | - | 111 | - | - | - | - | - | 1 | - |
| DS-88 | 1894 | - | - | - | 1 | - | - | - | - | - | - | - |
| Nasca-05 | 1980 | - | - | - | 83 | - | - | - | - | - | - | - |
| CV-33 | 1913 | - | - | - | - | - | - | - | - | 1 | - | - |
| CP-23a | 1980 | - | - | - | 106 | - | - | - | - | - | - | - |
| CP-24 | 1995 | - | - | - | 2 | - | - | - | - | - | - | - |
| CP-24a | 1995 | - | - | - | 36 | - | - | - | - | - | - | - |
| **Hors-Zone** | | | | | | | | | | | | |
| DS-04 | 1100 | - | 27 | - | - | - | - | - | - | - | - | 8 |
| DS-05 | 2210 | - | 7 | - | 28 | - | - | - | - | - | 1 | - |
| DS-06 | 2090 | - | - | - | 11 | - | - | - | - | - | - | - |
| DS-07 | 2170 | - | - | - | 10 | - | - | - | - | - | - | - |
| DS-09 | 2130 | 1 | - | - | 125 | - | - | - | - | - | 2 | - |
| DS-14 | 1560 | - | - | 8 | - | - | 2 | - | - | - | 1 | - |
| DS-33 | 2338 | - | - | - | 9 | - | - | - | - | - | 1 | - |
| DS-34 | 1031 | - | 15 | - | - | - | - | - | - | - | - | 24 |
| **Grand Vasiere** | | | | | | | | | | | | |
| KR-128 | 101 | - | - | - | - | - | - | - | - | - | - | - |
| KR-131 | 101 | - | - | - | - | - | - | - | - | - | - | - |
| KR-137 | 101 | - | - | - | - | - | - | - | - | - | - | - |

TABLE 1.—Continued.

| Station and Sample Number | Depth m | *Tetragonodon pellax* | *Domromeus heptathrix* | *Parasterope antyx* | *Parasterope styx* | *Synasterope hirpex* | *Synasterope helix* | *Synasterope phalanx* | *Synasterope index* | *Prionotoleberis rex* | *Prionotoleberis pax* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Station 5** | | | | | | | | | | | |
| DS-48 | 4203 | - | - | - | - | - | - | - | - | - | - |
| DS-53 | 4425 | - | - | - | - | - | - | - | - | - | - |
| CP-21 | 4453 | - | - | - | - | - | - | - | - | - | - |
| CP-21a | 4453 | - | - | - | - | - | - | - | - | - | - |
| CP-22 | 4475 | - | - | - | - | - | - | - | - | - | - |
| **Station 6** | | | | | | | | | | | |
| DS-25 | 2096 | - | - | - | - | - | - | - | - | - | - |
| DS-26 | 2076 | - | - | - | - | - | - | - | - | - | - |
| DS-49 | 1845 | - | - | - | - | - | - | - | - | 1 | - |
| DS-50 | 2124 | - | - | - | - | - | - | - | - | - | - |
| DS-51 | 2430 | - | - | - | - | - | 1 | - | - | - | - |
| DS-52 | 2006 | 4 | - | - | - | - | - | - | - | - | - |
| DS-87 | 1913 | - | - | - | - | - | - | - | - | 1 | - |
| DS-88 | 1894 | - | - | - | - | - | - | - | - | - | - |
| Nasca-05 | 1980 | - | - | - | - | - | - | - | - | - | - |
| CV-33 | 1913 | - | - | - | - | - | - | - | - | - | - |
| CP-23a | 1980 | 14 | 2 | - | - | - | - | - | - | - | - |
| CP-24 | 1995 | - | - | - | - | - | - | - | - | - | - |
| CP-24a | 1995 | - | - | - | - | - | - | - | - | - | - |
| **Hors-Zone** | | | | | | | | | | | |
| DS-04 | 1100 | - | - | - | - | - | - | - | - | - | - |
| DS-05 | 2210 | - | - | - | - | - | - | - | - | - | - |
| DS-06 | 2090 | - | - | - | - | - | - | - | - | - | - |
| DS-07 | 2170 | - | - | - | - | - | - | - | - | - | - |
| DS-09 | 2130 | - | - | - | - | - | - | - | - | - | - |
| DS-14 | 1560 | - | - | 7 | - | - | - | - | - | - | - |
| DS-33 | 2338 | - | 2 | - | - | - | - | - | - | - | - |
| DS-34 | 1031 | - | - | - | - | - | - | - | - | - | - |
| **Grand Vasiere** | | | | | | | | | | | |
| KR-128 | 101 | - | - | - | - | - | - | - | - | - | 1 |
| KR-131 | 101 | - | - | - | - | - | - | - | - | - | 1 |
| KR-137 | 101 | - | - | - | - | - | - | - | - | - | 1 |

shelf at the northern edge of the bay at a depth of 101 m.

I have included in the station list, but not in Table 1, specimens of *Azygocypridina imperialis* and *Gigantocypris muelleri* from 3 stations (44, 48, 49) collected on the NORATLANTE expedition of 1969. Station 44 is near BIOGAS station 6 at a depth of 1884–1911 m; station 48 is from the vicinity of BIOGAS station 1 at a depth of 1970–2149 m; station 49 is just north of BIOGAS station 1 at a depth of 1152–1200 m. The specimens were left off Table 1 because other myodocopids collected on that expedition have not yet been studied.

SAMPLING.—The collecting gear has been described and illustrated by Guennegan and Martin (1985). Abreviations preceding sample number identify the type of gear used in collecting each sample: B or CV—3 m beam trawl of Blake type; CP—5 m beam trawl of Honfleur type; DS or E—epibenthic sled of Hessler and Sanders type; KG—corer of U.S.N.E.L. type (0.25 sq. m of sampling surface); KR—box corer of Reineck type ($^1/_{16}$ sq. m. of sampling surface); NA—square stationary net trap; Nasca—square stationary net trap with attached camera; PL—submersible dive.

Blake Beam Trawl (B or CV): Myodocopids were collected in only 4 samples. Two samples each contained a specimen of *Gigantocypris muelleri* and each of the other 2 had a specimen of *Azygocypridina imperialis*, both are large forms. Small species were not collected in the trawl.

Honfleur Beam Trawl (CP): Myodocopids were collected in 23 samples; 12 of samples contained only *Gigantocypris muelleri*, the remaining samples contained other species, but mostly larger forms.

Epibenthic Sled (DS or E): This is a proven successful sampler for collecting myodocopids, and most specimens reported herein were collected with the sled (51 samples).

U.S.N.E.L. Corer (KG): Fifteen samples contained myodocopids but only 1 or 2 species, and no sample had more than 7 specimens. This device does not cover sufficient area to collect many myodocopids.

Box Corer (KR): Four samples contained myodocopids but only 1 specimen was in each sample. The area covered by the box is apparently too small to collect many myodocopids in the study area.

Stationary Square Net Trap (NA or Nasca): Only 3 samples contained myodocopids; 2 had only 1 or 2 specimens of *Azygocypridina imperialis* but the 3rd had 83 specimens of *Metavargula quintuplex;* the abundance of *M. quintuplex* in the samples suggests that it is a scavenger.

Dive (PL), Collected in Submersible: Two samples collected in this way; one had a single specimen, the other 2 specimens.

DISPOSITION OF SPECIMENS.—Most of the specimens have been deposited at the Muséum National d'Histoire Naturelle, Paris, France, and some of these have been assigned MNHN numbers. A few specimens have been deposited at the National Museum of Natural History, Smithsonian Institution; these have been assigned USNM numbers. All specimens without numbers have been deposited at the Paris museum. The disposition of specimens is given in the text where the species is described and in "Station Data with Specimens Examined."

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## Zoogeographical Relationships

The pelagic species *Gigantocypris muelleri* is widespread in the North Atlantic. The benthic *Azygocypridina imperialis* has been reported previously at latitudes between 21°N and 60°N. *Parasterope styx* has been reported previously from abyssal depths in the Peru-Chile Trench west of Chile. *Philomedes lilljeborgii* has been reported from the west coasts of Norway and Sweden at shelf and bathyal depths and from off Mauritania at bathyal depths. The single species collected on the continental shelf of the Bay of Biscay, *Prionotoleberis pax*, is also found on the shelf and upper slope off Mauritania. The remaining species in the collections are new. Two new species collected at abyssal depths have been referred to the new genera *Rheina* and *Domromeus*. Two new species collected at bathyal and abyssal depths have been referred to the genus *Paradoloria*, a genus not reported deeper than shelf depths elsewhere. A new species collected at abyssal depths has been referred to *Hadacypridina*, a genus reported previously in the Kermadec Trench north of New Zealand, also at abyssal depths. Three new species collected at bathyal and abyssal depths have been referred to *Metavargula*, a genus widespread at similar depths. One new species collected at bathal and abyssal depths has been referred to *Tetragonodon*, a species collected at similar depths elsewhere. The remaining species collected at bathyal and abyssal depths have been referred to 3 genera (*Philomedes*, *Parasterope*, and *Synasterope*) widely distributed elsewhere at depths ranging from shelf to abyssal, and to the genus *Prionotoleberis*, formerly reported from shelf depth

The West European Basin is an extensive East-West oriented basin with its western end near the mid-Atlantic ridge and its eastern end forming the Bay of Biscay. The Bay of Biscay is delimited at its northern end by the Île d'Ouessant, France, and

at its southern end by Cape Ortegal, Spain. A line drawn through these points forms the outer boundary of the bay. The following stations are within the bay: BIOGAS stations 5, 6, and NORATLANTE station 44, all at the southern end of the bay, off Spain; and station "Grande Vasiere" at the northern end of the bay, off France. The following stations are to the west of the bay: BIOGAS stations 1–4, NORATLANTE stations 48, 49, and Hors-Zone samples. Of the 21 species in the collections, 11 are in the Bay of Biscay and 18 are from west of the bay (Table 2). Eight of the bay species were also collected outside the bay. The faunal resemblance between the two areas is high (Simpson index: 73).

TABLE 2.—Distribution of species in study area (+ = species present, − = species absent).

| Taxon | Bay of Biscay | West of Bay of Biscay |
|---|---|---|
| *Azygocypridina imperialis* | + | + |
| *Paradoloria lippa* | − | + |
| *Paradoloria magna* | − | + |
| *Metavargula quintuplex* | + | + |
| *Metavargula hex* | + | + |
| *Metavargula bilix* | − | + |
| *Rheina prex* | + | + |
| *Hadacypridina biscayensis* | − | + |
| *Gigantocypris muelleri* | + | + |
| *Philomedes pentathrix* | + | + |
| *Philomedes lilljeborgii* | − | + |
| *Tetragonodon pellax* | + | − |
| *Domromeus heptathrix* | + | + |
| *Parasterope antyx* | − | + |
| *Parasterope styx* | − | + |
| *Synasterope hirpex* | − | + |
| *Synasterope helix* | + | + |
| *Synasterope phalanx* | − | + |
| *Synasterope index* | − | + |
| *Prionotoleberis rex* | + | − |
| *Prionotoleberis pax* | + | − |

### Relationship between Eye Development and Water Depth

The relationship between development of lateral eyes in myodocopids and water depth in southern oceans has been discussed by Kornicker (1975a:42). Within the depth interval 2000–4000 m, 2 of 11 (18%) of known benthic myodocopids in the southern oceans have eyes (Kornicker, 1975a, table 17); whereas, in the present study area and within the same depth interval, 5 of 13 (38%) have eyes. (Members of the Azygocypridininae, which have hirsute flap-like eyes without ommatidia, have been omitted from the calculations.) The percent of eye-bearing species depends to a large degree on the familial composition of the fauna, because some families experience eye reduction with depth at a faster rate than others. Kornicker (1975a:48) reported that in the southern oceans (35°S to Antarctica) all benthic myodocopids (excluding the Azygocypridininae) are blind below 3775 m; in the present study area all were blind below 3480 m (Table 3). The maximum depth of eye-bearing benthic species for the family Cypridinidae (excluding Azygocypridininae) is 3775 m in the southern oceans and 2210 m in the present study area; for the family Philomedidae, 3382 m in the southern oceans and 3480 m in the present study area; for the Cylindroleberididae, 1212 m in the southern oceans, and less than 1560 m in the present study area (the only samples shallower than 1560 m that contained cylindroleberids were from 101 m; the samples contained 3 specimens of *Prionotoleberis pax*, which has well-developed eyes; therefore, the maximum depth of eye-bearing species must lie between 101–1560 m, and probably is closer to the latter depth). Adult males have well-developed eyes and females minute eyes in both species of *Philomedes* in the collection (*P. lilljeborgii*, 1031–2147 m, and *P. pentathrix*, 1560–3480 m). In other bathyal and abyssal benthic species in the collection of which both sexes are known the lateral eyes are the same in males and females, and are either minute or absent (Table 3).

### Vertical Distribution and Faunal Composition

The number of benthic species in the collections increases with depth: 14 species at bathyal depths, and 16 species at abyssal depths. Of these, 3 species was collected only within the bathyal zone (200–2000 m); 8 were collected only within the abyssal zone (>2000–6000 m); and 9 were collected both in the bathyal and abyssal zones. The increase in species with depth is probably an artifact resulting from so few samples having been collected in the upper half of the bathyal zone; the depth range of the samples, excluding the 3 collected on the shelf at 101 m, is 1031–4825 m. Kornicker and Caraion (1974, 1977, 1978) reported about 25 species in the upper half of the bathyal zone off Mauritania and the southern part of Spanish Sahara suggesting that more than 8 species are living in the bathyal zone of the present study area. The number of benthic abyssal myodocopid species (17) in the study area is quite high considering that only 30 have been previously reported from the worlds oceans (Kornicker, 1975a, table 4; Hartmann, 1985:128; Table 4).

The benthic bathyal and abyssal myodocopids in the study area are represented mostly by members of the Cylindroleberididae and Cypridinidae, each being represented by 8 species in 4 genera. The Philomedidae are represented by 3 species in 2 genera. The Rutidermatidae and Sarsiellidae are not represented in the collections. Except for the absence of sarsiellids, the families are not unlike those at bathyal and abyssal depths in other areas (Table 5).

### Relationship of Feeding Habits to Distribution

The feeding habits of myodocopid ostracodes have been discussed by many investigators (Kornicker, 1975a:38–42, table 16; Moguilevsky and Gooday, 1977:263; Cohen,

TABLE 3.—Development of lateral eyes of species in study area.

| Taxon (depth range m) | Female | Male |
|---|---|---|
| *Azygocypridina imperialis* (1884–2813) | hirsute flap | hirsute flap |
| *Paradoloria lippa* (1031–2210) | minute | minute |
| *P. magna* (1560–2147) | minute | minute |
| *Rheina prex* (4125–4825) | absent | absent |
| *Metavargula quintuplex* (1845–3742) | absent | absent |
| *M. bilix* (1560–2147) | minute | minute |
| *M. hex* (4203–4240) | absent | absent |
| *Gigantocypris muelleri* (1152–4721) | well developed | well developed |
| *Hadacypridina biscayensis* (3250–4550) | absent | no data |
| *Philomedes pentathrix* (1560–3480) | minute | well developed |
| *P. lilljeborgii* (1031–2147) | minute | well developed |
| *Tetragonodon pellax* (1980–2006) | absent | absent |
| *Domromeus heptathrix* (1980–2360) | absent | no data |
| *Parasterope antyx* (1560) | absent | absent (juvenile) |
| *P. styx* (3250–3742) | absent | absent |
| *Synasterope hirpex* (4125–4715) | absent | absent |
| *S. helix* (2165–2430) | absent | no data |
| *S. phalanx* (2147) | absent | no data |
| *S. index* (2906) | no data | absent (juvenile) |
| *Prionotoleberis rex* (1845–1913) | absent | no data |
| *P. pax* (101) | well developed | well developed |

TABLE 4.—Abyssal (>2000 m) benthic Myodocopina.

| Taxon | Depth range (m) | Abyssal locality |
|---|---|---|
| CYPRIDINIDAE | | |
| CYPRIDININAE | | |
| *Hadacypridina biscayensis*, n. sp. | 3250–4550 | West of Bay of Biscay |
| *H. bruuni* Poulsen, 1962 | 5340–6000 | Southwest Pacific Basin, Kermadec Trench |
| *Doloria levinsoni* Kornicker, 1975 | 426–2820 | Falkland Trough, Scotia Ridge |
| *Metavargula adinothrix* Kornicker, 1975 | 1796–3775 | Falkland Trough, Scotia Ridge, Drake Passage |
| *M. ampla* Kornicker, 1970 | 1927–1997 | Peru-Chile Trench |
| *M. quintuplex*, n. sp. | 1845–3742 | In and west of Bay of Biscay |
| *M. bilix*, n. sp. | 1560–2147 | West of Bay of Biscay |
| *M. hex*, n. sp. | 4203–4240 | In and west of Bay of Biscay |
| *Rheina prex*, n. sp. | 4125–4825 | In and west of Bay of Biscay |
| *Paradoloria lippa*, n. sp. | 1031–2210 | West of Bay of Biscay |
| *Paradoloria magna*, n. sp. | 1560–2147 | West of Bay of Biscay |
| *Vargula biarticulata* Chavtur, 1983 | 3270 | East Pacific near Mexico |
| *V. sutura* Kornicker, 1975 | 3386–3477 | Albatross Cordillera |
| AZYGOCYPRIDININAE | | |
| *Azygocypridina imperator* Brady, 1880 | 2012 | Southwest Pacific Basin |
| *A. imperialis* Brady and Norman, 1896 | 1884–2930 | Northeast Atlantic, Bay of Biscay |
| *Isocypridina quatuorsetae* Kornicker, 1975 | 248–3170 | Scotia Ridge, South Georgia |
| PHILOMEDIDAE | | |
| PHILOMEDINAE | | |
| *Igene curtus* Chavtur, 1983 | 4945–5240 | Kurile–Kamchatka Basin |
| *I. walleni* Kornicker, 1975 | 3702–4303 | Peru-Chile Trench, Albatross Cordillera |

TABLE 4.—Continued.

| Taxon | Depth range (m) | Abyssal locality |
|---|---|---|
| *Philomedes lilljeborgii* (Sars, 1865) | 50–2147 | Northeast Atlantic, west of Bay of Biscay |
| *P. pentathrix*, n. sp. | 1560–3480 | In and west of Bay of Biscay |
| *P. ramus* Kornicker, 1975 | 3219 | Chile Rise |
| *P. tetrathrix* Kornicker, 1975 | 566–3382 | Chile Rise, Scotia Ridge, edge of South Sandwich Trench |
| PSEUDOPHILOMEDINAE | | |
| *Tetragonodon ctenorynchus* (Brady, 1887) | 636–2995 | Northeast Atlantic |
| *T. pellax*, n. sp. | 1980–2006 | Bay of Biscay |
| CYLINDROLEBERIDIDAE | | |
| CYLINDROLEBERIDINAE | | |
| *Bathyleberis grossmani* Kornicker, 1975 | 3431–4303 | Peru-Chile Trench, Drake Passage, Albatross Cordillera |
| *Empoulsenia polythrix* Chavtur, 1983 | 85–2570 | Northwest Pacific, Sea of Japan, Okhotsk and Bering Sea |
| *Domromeus heptathrix*, n. sp. | 1980–2360 | In and west of Bay of Biscay |
| *Parasterope antyx*, n. sp. | 1560–2190 | West of Bay of Biscay |
| *P. styx* Kornicker, 1975 | 3250–4303 | West of Chile, west of Bay of Biscay |
| *Skogsbergiella* sp. indet. Kornicker, 1975 | 3035 | Weddell Seas, Albatross Cordillera |
| *Synasterope dimorpha* (Hartmann, 1965) | 112–2563 | Chile Rise |
| *S. duplex* Kornicker, 1975 | 3035 | Weddell Sea |
| *S. helix*, n. sp. | 2165–2430 | In and west of Bay of Biscay |
| *S. hirpex*, n. sp. | 4125–4715 | West of Bay of Biscay |
| *S. index*, n. sp. | 2906 | West of Bay of Biscay |
| *S. nystax* Kornicker, 1975 | 2747–4006 | Falkland Trough, edge of Sandwich Trench |
| *S. phalanx*, n. sp. | 2147 | West of Bay of Biscay |
| *S. polythrix* Kornicker, 1975 | 4004–4031 | Drake Passage |
| *Synasterope* sp. A Kornicker, 1970 | 2504–2414 | Peru-Chile Trench |
| *Synasterope* sp. B Kornicker, 1970 | 4383–4516 | Peru-Chile Trench |
| SARSIELLIDAE | | |
| SARSIELLINAE | | |
| *Spinacopia mastix* Kornicker, 1975 | 3035 | Weddell Sea |
| *S. menziesi* Kornicker, 1969 | 2818–3500 | Scotia Ridge |
| *S. octo* Kornicker, 1969 | 3495–4758 | Southeast Pacific Basin, Drake Passage |
| *S. torus* Kornicker, 1970 | 1962–4364 | Peru-Chile Trench |
| *Parasarsiella globulus* (Brady, 1887) | 932–2330 | Between Canary Islands and Cape Verde Islands; off St. Croix, U.S. Virgin Islands |
| *Cypridinidarum* genera dubia et species dubiae | | |
| *Streptoleberis favosa* Brady and Norman, 1896 | 836–2330 | Off Morocco and Mauritania |
| *S. rectirostris* Brady and Norman | 2333–2794 | Bay of Biscay and Mauritania |

TABLE 5.—Familial components of known abyssal (>2000 m) benthic Myodocopina.

| Taxon | Number of Genera | Number of Species |
|---|---|---|
| Cypridinidae | 8 | 16 |
| Cypridininae | 6 | 13 |
| Azygocypridininae | 2 | 3 |
| Philomedidae | 3 | 8 |
| Philomedinae | 2 | 6 |
| Pseudophilomedinae | 1 | 2 |
| Sarsiellidae | 2 | 5 |
| Sarsiellinae | 2 | 5 |
| Cylindroleberididae | 6 | 16 |
| Cylindroleberidinae | 6 | 16 |
| Total | 19 | 45 |

1983:235; and Angel, 1983:540). The Rutidermatidae and Sarsiellidae, which were not collected at bathyal and abyssal depths in the present study, are predators. The Cypridinidae comprise predators, scavengers, and detritus feeders. Of taxa collected in this study, the benthic cypridinids are probably scavengers, except for *Azygocypridina imperialis* which is both a predator and scavenger. The pelagic *Gigantocypris muelleri* is both a predator and scavenger. The Cylindroleberididae are filter feeders, and the Philomedidae are detritus feeders. At bathyal and abyssal depths filter feeders and scavengers are more abundant than detritus feeders, and predators are extremely rare. The distribution of feeding types is similar to that found elsewhere at similar depths (Kornicker, 1975a:38).

## Parasites

Stromberg (1983:87) redescribed the cryptoniscus larva of the parasitic isopod *Onisocryptus sagittus* Schultz, 1977, from specimens that had been found on myodocopids, some of which had been collected west of the the Bay of Biscay (47°32'N, 9°34'W, 4249 m). The ostracodes were identified as *Metavargula* and *Vargula*, but Stromberg did not specify whether 1 or both had been collected in the vicinity of the Bay of Biscay. The present collection did not have species of *Vargula*, but specimens of *Metavargula quintuplex* are abundant and 3 were observed to have cyproniscid parasites (Table 6). Cyproniscid isopods were observed in 4 species collected at depths of 1980–3742 m, and 3 species from depths of 1913–2430 m were parasitized by choniostomatid copepods (Table 6).

## Suborder MYODOCOPINA Sars, 1866

The Myodocopina comprise 5 families: Cypridinidae, Philomedidae, Cylindroleberididae, Sarsiellidae, and Rutidermatidae. Only the first three families are represented in the collections reported upon herein. Of the remaining families, the Rutidermatidae have have not been reported elsewhere at abyssal depths and appear to be restricted to the continental shelf and upper slope; 1 species, *Rutiderma compressum* Brady and Norman, 1896, has been reported from the Bay of Biscay at 150 m (Brady and Norman, 1896:673). The Sarsiellidae are represented at bathyal and abyssal depths elsewhere by only 2 genera, *Spinacopia* Kornicker, 1970 and *Parasarsiella* Brady, 1887; the family has not yet been reported at any depth in the study area.

### CYPRIDINIDAE Baird, 1850

The Cypridinidae comprise 2 subfamilies, Cypridininae and Azygocypridininae. Both are represented in the collections.

### CYPRIDININAE Baird, 1850

The Cypridininae comprise 2 tribes, Cypridinini and Gigantocypridinini; both are represented at abyssal depths in the study area.

### CYPRIDININI Baird, 1850

The Cypridinini are represented in the collections by 4 genera, *Paradoloria* Hanai, 1974 (2 species), *Metavargula* Kornicker, 1970 (3 species), *Rheina*, new genus (1 species), and *Hadacypridina* Poulsen, 1962 (1 species). The genus *Paradoloria* Hanai, 1974, has been reported previously from the Bay of Biscay by Granata and Caporiacco (1949:7), who described a species not represented in the present collections, but which is discussed herein. The pelagic species *Macrocypridina castanea* (Brady, 1897), of the genus *Macrocypridina* Skogsberg, 1920, has been reported previously in the Bay of

TABLE 6.—Ostracodes parasitized by Isopoda or Copepoda (+ = present, – = absent).

| Taxon, sample, depth | Parasite | |
|---|---|---|
| | Isopoda | Copepoda |
| *Metavargula quintuplex*, n. sp. | | |
| Adult female, DS-41, 3548 m | + | – |
| Juvenile, CP-23a, 1980 m | + | – |
| Adult female, DS-60, 3742 m | + | – |
| *Philomedes pentathrix*, n. sp. | | |
| Juvenile, CP-37, 2175 m | + | – |
| *Parasterope styx* Kornicker, 1970 | | |
| Adult male, DS-41, 3548 m | + | – |
| Adult female, DS-60, 3742 m | + | – |
| A-1 female, DS-66, 3480 m | + | – |
| A-1 female, DS-75, 3250 m | + | – |
| *Synasterope index*, n. sp. | | |
| Juvenile male, DS-57, 2906 m | + | – |
| *Synasterope helix*, n. sp. | | |
| A-1 female, DS-51, 2430 m | – | + |
| *Prionotoleberis rex*, n. sp. | | |
| Adult female, DS-87, 1913 m | – | + |
| *Domromeus heptathrix*, n. g., n. sp. | | |
| Adult female, CP-23a, 1980 m | – | + |

Biscay by others (Fowler, 1909:296; Poulsen, 1962:121, and Angel, 1977:246), but was not in the present collections.

During the present study I examined a paratype of the type species of the bathyal genus *Bathyleberis*, *B. parvispinosa* Poulsen, 1962, from the West Indies, and have included a supplementary description of that species and a discussion of the genus.

### *Paradoloria* Hanai, 1974

*Paradoloria* Paulsen, 1962:146 [nomen nudum].—Hanai, 1974:119.

TYPE SPECIES.—*Cypridina dorsoserrata* Müller, 1908 (designation by Hanai, 1974:119).

DISTRIBUTION.—Widespread; the southernmost record is in the vicinity of Australia (37°28′S, 138°55′E) and the northernmost record is in the Bay of Biscay. Previous known depth range of the genus was from just below the intertidal zone to 1829 m (*P. gracilis* (Brady, 1880)). Specimens reported upon herein were collected west of the Bay of Biscay at depths of 1031–2210 m, slightly extending the depth at which the genus has been collected.

COMPOSITION.—The main difference between members of the genera *Paradoloria* and *Doloria* (Skogsberg, 1920) is that in the former the endopodite of the 2nd antenna is similar to that of the female, whereas, in the latter it forms a clasping organ. Males of species that have been referred to *Paradoloria* are known only for the following: *P. dorsoserrata* Müller, 1908; *P. vanhoeffeni* Müller, 1908; *P. pellucida* (Kajiyama, 1912); *P. australis* Poulsen, 1962, and the new species *P. lippa*, described herein. Males of species that have been referred to *Doloria* are known only for the following: *D. levis* Skogsberg, 1920; *D. pectinata* Skogsberg, 1920; *D. levinsoni* Kornicker, 1975a:107, and *D. isaacsi* Kornicker, 1975a:118. Species in which the male is unknown, and therefore, could belong to either genus are as follows: *Paradoloria gracilis* (Brady, 1880); *P. acorensis* (Granata and Caporiacco, 1949); *P. nuda* Poulsen, 1962; *P. angulata* Poulsen, 1962; the new species, *P. magna*, described herein; *Doloria septenaria* Kornicker, 1975a:114, and *D. mawsoni* Kornicker, 1975. Three species in the Bay of Biscay have been referred to *Paradoloria*: *P. acorensis*, *P. lippa*, and *P. magna*.

Poulsen (1962:147) proposed that *Cypridina capensis* Cleve, 1905, should probably be referred to *Paradoloria*. The presence of a bristle on the 2nd endopodial joint of the 2nd antenna of that species (Cleve, 1905, pl. 7: fig. 7) suggests that it may be closer to *Vargula*; unfortunately, the structure of the upper lip is unknown.

### Key to Species of *Paradoloria* in the Study Area

1. Carapace shorter than 2.5 mm; furca with 11 claws on each lamella . . . . ***P. lippa***
   Carapace longer than 3.0 mm; furca with either 10 or 12 claws on each lamella . . . . . 2
2. Furca with 10 claws on each lamella . . . . . ***P. magna***
   Furca with 12 claws on each lamella . . . . . ***P. acorensis***

### *Paradoloria acorensis* (Granata and Caporiacco, 1949)

FIGURE 2

*Cypridina (Doloria) acorensis* Granata and Caporiacco, 1949:7, pl. 1: fig. 3, pl. 3: figs. 6–13.

*Paradoloria acorensis*.—Poulsen, 1962:147 ["probably to be included in genus"].—Kornicker, 1975a:65.

SYNTYPES.—Two females (Granata and Caporiacco, 1949; 1897, Sta 858; 1903, sta 1453).

SYNTYPE LOCALITIES.—38°45′N, 28°56′W (Azores), 1482 m; 45°02′N, 3°16′W (Bay of Biscay), 1455 m.

MATERIAL.—Through the courtesy of Dr. C. Carpine, Conservator of Collections at the Institute Océanographique, Monaco, I received 2 vials. One vial contained the label "Station 858, *Cypridina acorensis*, Nom. 325048, Caporiacco det." and a right valve but no appendages. The second vial contained the label "Station 1453, *Cypridina acorensis*, Nom. 325053, Caporiacco det.," but did not have a specimen. Dr. Carpine was unable to find additional material at the institute.

DISTRIBUTION.—One of the localities listed by Granata and Caporiacco, (1949:38) was station 858, which is near the Azores, the other was station 1453, which is in the Bay of Biscay. The coordinates given by Granata and Caporiacco (1949:38) for station 1453 were 38°45′N, 3°16′W. Because the given locality would be on land, I wrote to Dr. Carpine for information, and was kindly sent corrected coordinates, which are given above in "Syntype Localities."

DIAGNOSIS.—Carapace length 3.97 mm. 7th limb with 45 bristles. Furca with 12 claws on each lamella.

SUPPLEMENTARY DESCRIPTION OF SYNTYPE (Figure 2).—Carapace oval in lateral view with posteroventral margin more evenly rounded than truncate posterodorsal margin (Figure 2*a*).

*Infold:* Infold of rostrum with about 24 bristles, mostly divided; 2 bristles present on ventral margin of rostrum near inner end of incisur (Figure 2*b*). Infold of caudal process with narrow list bearing numerous minute bristles; posterior edge of list of caudal process fairly linear but with minute projections visible at high magnification (× 350) (Figure 2*a*).

*Size:* Right valve of No. 325048, length 3.97 mm, height 2.25 mm.

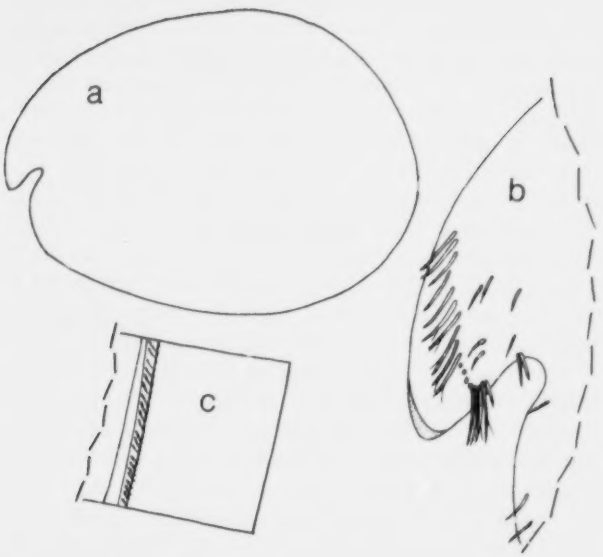



FIGURE 2.—*Paradoloria acorensis* (Granata and Caporiacco), female, syntype, no. 325048, right valve from inside, length 3.97 mm: *a*, outline; *b*, anterior showing bristles of infold; *c*, segment of posterior showing minute bristles and posterior projections of narrow list of broad infold of caudal process.

DISCUSSION.—The genera *Doloria* and *Paradoloria* are defined mainly on the endopodite of the 2nd antenna of the adult male being a clasping organ on the former and similar to that of the female in the latter. Because of this, it is not possible with certainty to recognize to which genus *P. acorensis* belongs. The upper lip of the species illustrated by Granata and Caporiacco (1949, pl. 3: figs. 7, 8) is similar to the lips of 2 species described herein: *Paradoloria lippa* and *P. magna*. The large size of the carapace of *P. acorensis* suggests closer affinity with *P. magna* than with *P. lippa*. Each lamella of the furca of *P. magna* bears only 10 claws compared to 12 on *P. acorensis*, but the fewer claws on the former species could be the result of it being a juvenile.

### *Paradoloria lippa*, new species

FIGURES 3–6

*Paradoloria* species A.—Kornicker, 1985:410–412 [excluding specimens from samples DS-14 and DS-50, which are referred to *Paradoloria magna* and *Azygocypridina imperialis*, respectively, herein].

ETYMOLOGY.—From the Latin *lippus* (dim-sighted), in reference to the poorly developed lateral eyes of the species.

HOLOTYPE.—Complete ovigerous female in alcohol, MNHN Os 133, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS III, R.V. *Jean Charcot*, west of Bay of Biscay, 47°32′42″N, 8°36′30″W, 2147 m, sta 1, sample DS-36, 24 Aug 1973.

PARATYPES.—BIOGAS I, R.V. *La Perle*, sta Hors-Zone: sample DS-04, 27 specimens, including adults and juveniles; sample DS-05, 1 female (USNM 157974) + 6 specimens. BIOGAS II, R.V. *Jean Charcot*, sta 1: sample DS-34, 1 ovigerous female (USNM 158584) + 14 specimens. BIOGAS III, R.V. *Jean Charcot*, sta 1: sample DS-36, 1 adult male (USNM 193167A) + 4 adult males (USNM 193167B) + 7 adult females and 1 juvenile (USNM 193167C) + 224 specimens, including adults and juveniles (some juveniles could be *Paradoloria magna*, new species, described herein).

DISTRIBUTION.—West of Bay of Biscay, 1031–2210 m.

DESCRIPTION OF ADULT FEMALE (Figures 3, 4).—Carapace smooth, oval in lateral view with caudal process almost imperceptible from smooth curvature of posterior outline of valve; incisur small, at valve midheight.

*Infold* (Figure 3*b*): Broad in area of rostrum, caudal process, and ventral to incisur, narrower elsewhere; infold behind rostrum with 8 or 9 long bristles and several small bristles (USNM 157974); 2 long bristles present at inner end of incisur; 1 small bristle present posterior to inner end of incisur, and 1 bristle near inner margin of infold ventral to inner end of incisur; anteroventral infold with 22 bristles forming row along list; 6 additional small bristles forming row along anteroventral infold inward from list bristles; posterior edge of list of caudal process with numerous minute processes (Figure 3*b*); about 15 small bristles forming row along list of caudal process (Figure 3*b*); outer edge of caudal process with about 20 pores, each containing minute process.

*Selvage:* Lamellar prolongation with smooth outer edge present along anterior and ventral margin of valves; prolongation divided at inner end of incisur.

*Size:* Holotype, length 2.31 mm, height 1.58 mm; USNM 157974, length 2.29 mm, height 1.51 mm; BIOGAS I, DS-05, length 2.33 mm, height 1.42 mm; USNM 193167C, 3 specimens: length 2.36 mm, height 1.50 mm, length 2.34 mm, height 1.41 mm, length 2.20 mm, height 1.44 mm; USNM 158584, length 2.21 mm, height 1.51 mm.

*First Antenna* (Figure 3*c*): 1st joint bare. 2nd joint with faint spines forming rows along ventral and dorsal margins. 3rd joint short, with 2 bristles (1 ventral, 1 dorsal). 4th joint elongate, with 2 terminal bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 9 long proximal filaments, 2 slender distal filaments, and bifurcate tip, 6th joint with short medial bristle. 7th joint: a-bristle spinous, longer than bristle of 6th joint; b-bristle with tip missing on illustrated limb, with 5 short filaments (some with marginal spines) on remaining part; c-bristle with tip missing on illustrated limb, with about 9 filaments on remaining part (distal filament much longer than others). 8th joint: d- and e-bristles longer than b-bristle, bare with blunt tips (tip of e-bristle missing on illustrated limb).

*Second Antenna* (Figure 3*d*): Protopodite with small spinous medial bristle. Endopodite 3-jointed: 1st joint with 4 proximal bristles (3 short, 1 long) and 1 long distal bristle; 2nd joint bare; 3rd joint minute, only weakly separated from 2nd joint, with long terminal filament. Exopodite: bristle of 2nd joint reaching just past 9th joint, with about 35 slender ventral

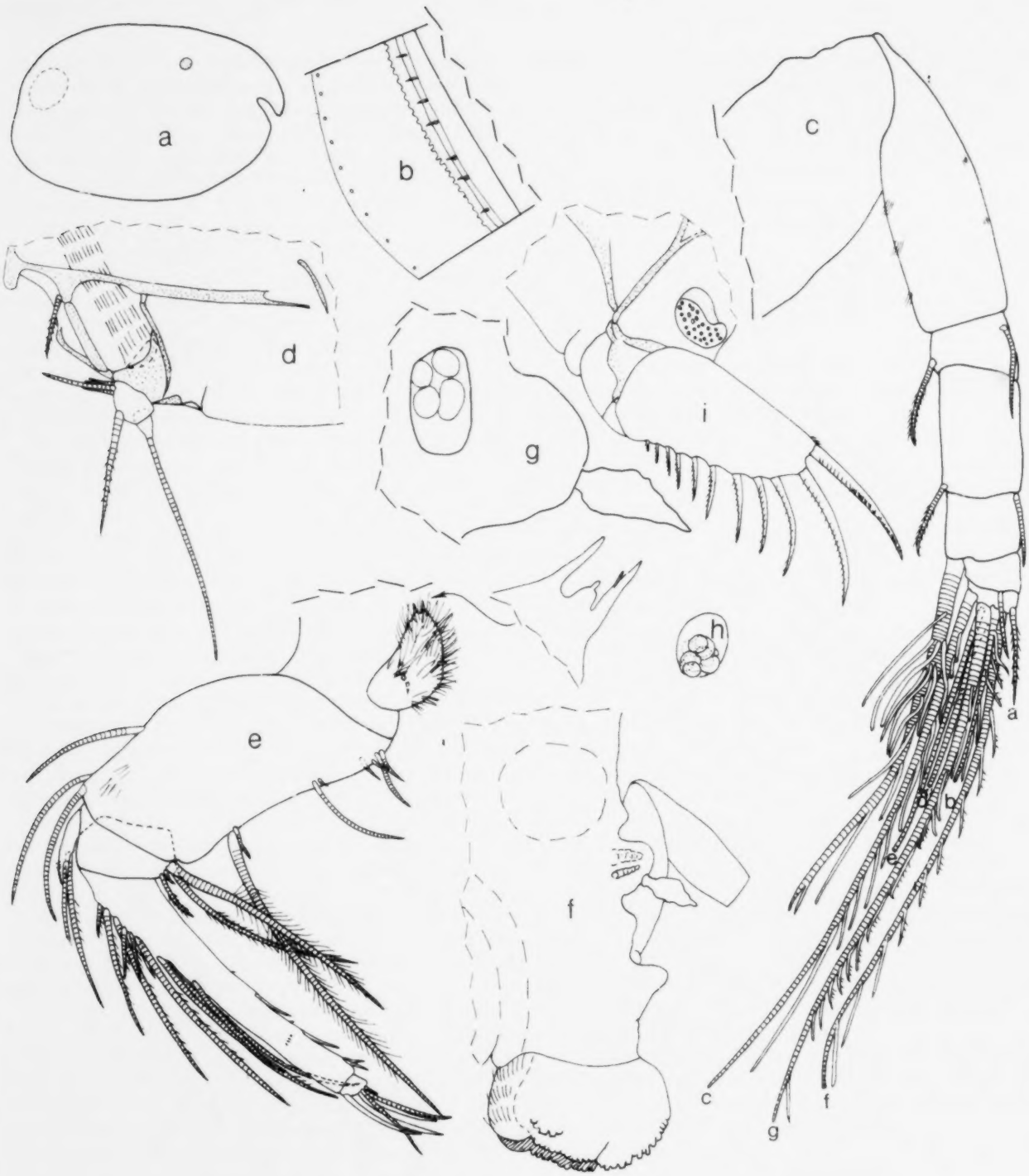



FIGURE 3.—*Paradoloria lippa*, new species, ovigerous female, paratype, USNM 157974: *a*, complete specimen from right side showing locations of right lateral eye (stippled) and dashed outline of egg, length 2.29 mm; *b*, segment of posterior edge of caudal process of left valve from inside showing list with bristles and posterior processes along edge; *c*, left 1st antenna, medial view; *d*, distal part of protopodite and endopodite of right 2nd antenna (sclerites stippled), medial view; *e*, right mandible, medial view; *f*, anterior of body showing dashed circular outline of heart, medial eye and Bellonci organ, upper lip, anterior process between medial eye and upper lip, 1st and 2nd joints of left 1st antenna, and dashed canal of esophagous; *g*, right lateral eye, medial eye and bellonci organ; *h*, left lateral eye; *i*, right lamella of furca, right genitalia, Y-sclerite (scleritized parts stippled).

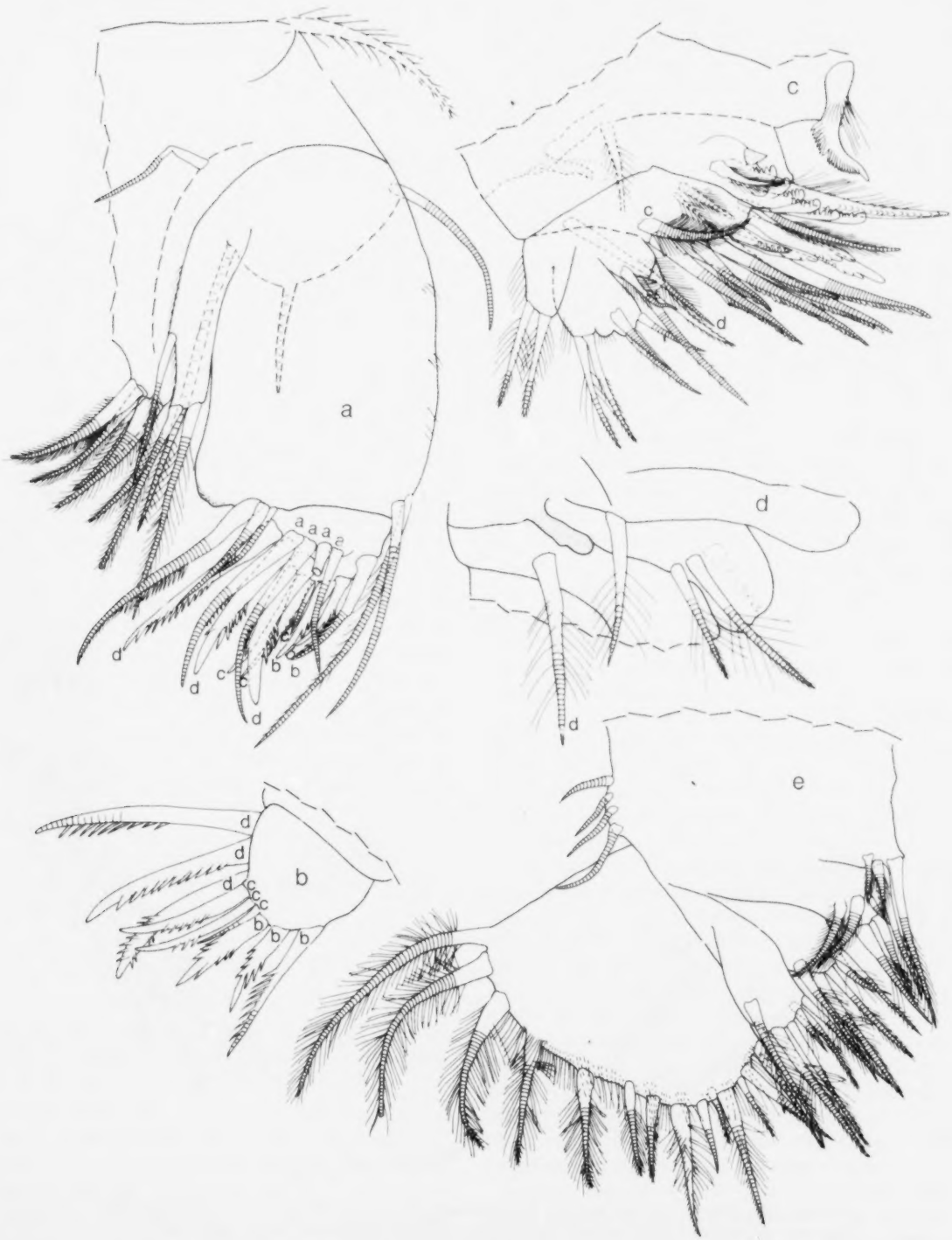



FIGURE 4.—*Paradoloria lippa*, new species, ovigerous female, paratype, USNM 157974: *a*, right maxilla, lateral view; *b*, tip of left maxilla, medial view; *c*, left 5th limb, posterior view; *d*, right 5th limb, anterior view; *e*, right 6th limb, medial view.

spines, and about 25 very slender spines along proximal half of dorsal margin; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 4 bristles (2 long, 1 medium, 1 short), all with natatory hairs, no spines; joints 3–8 with small basal spines; spine of 8th joint about same length as 9th joint; 9th joint with lateral spine slightly longer than length of joint.

*Mandible* (Figure 3*e*): Spinous coxale endite with 2 stout terminal spinous processes having small peg between them (Figure 3*e*); small ringed bristle near base of endite. Basale: ventral margin with 3 a-bristles, 1 b-bristle, 2 c-bristles, and 2 d-bristles; dorsal margin of basale with 2 midbristles and 2 terminal bristles; medial side with few distal hairs. 1st endopodial joint with few terminal spines on dorsal margin and with 4 ventral bristles (2 long, 2 short), all except smallest bristle with marginal spines. 2nd endopodial joint: medial side with few distal spines; ventral margin with 4 slender distal bristles forming 3 groups of 1, 1, and 2 bristles (medial bristle of distal pair about same diameter as lateral bristle); dorsal margin with 7 long bristles, 1 medium bristle with short marginal spines, and 11 cleaning-type bristles with long marginal spines (not all spines or bristles shown on illustrated limb). End joint with 3 subequal smooth claws and 4 bristles (no bristles with broad proximal part); lateral dorsal bristle not shown on illustrated limb). Exopodite with hirsute tip and 2 distal bristles (proximal of these twice length of other).

*Maxilla* (Figure 4*a,b*): Endite I with about 11 spinous bristles; endite II with about 7 spinous bristles; endite III with 1 proximal and about 6 terminal spinous bristles. Precoxale and coxale with fringe of dorsal hairs; coxale with stout dorsal bristle with long proximal hairs and very faint, short, distal hairs. Basale with 3 bristles (1 bare dorsal, 1 bare medial, 1 long spinous ventral, near base of exopodite). Exopodite with 3 bristles (1 proximal, 2 terminal), all with long marginal hairs. 1st endopodial joint with 2 alpha-bristles (longer with faint marginal hairs), and 3 beta-bristles (longest pectinate, middle with few proximal spines, shortest bare); cutting tooth with 2 or 3 low rounded processes. 2nd endopodial joint with 4 a-bristles (inner of these bare, others with spines), 3 pectinate b-bristles, 3 pectinate c-bristles (anterior bristle small, ringed), and 3 stout pectinate d-bristles.

*Fifth Limb* (Figure 4*c,d*): Protopodite with elongate tooth. 3 endites present, each with several spinous bristles; endite III with 1 stout pectinate bristle (only bristle shown on illustrated limb). 1st exopodial joint: main tooth with triangular peg and 6 constituent teeth; small spinous bristle proximal to peg; anterior side with 3 spinous bristles in distal group and 1 spinous proximal bristle near tooth of protopodite (bristle may be on 3rd endite). 2nd exopodial joint with about 11 a- and b-bristles, 1 short spinous c-bristle, and 1 long spinous d-bristle. 3rd exopodial joint with 3 bristles on inner lobe and 2 on outer hirsute lobe. 4th exopodial joint with 3 bristles and low hirsute rounded process near base of 5th joint. 5th exopodial joint hirsute, with 2 terminal bristles.

*Sixth Limb* (Figure 4*e*): Endite I with 2 short medial bristles and 2 long terminal bristles; endite II with 3 short medial bristles and 2 long terminal bristles; endite III with 5 bristles; endite IV with 7 bristles. End joint with 14 or 15 bristles (posterior 2 hirsute to tip, others with only short spines, or hirsute proximally and with short spines near tip). Four bare bristles in place of epipodial appendage.

*Seventh Limb:* Each limb with about 30 bristles; each bristle with up to 5 bells; terminus with comb of about 12 teeth; peg absent.

*Furca* (Figure 3*i*): Each lamella with 11 claws; claw 4 about same length, or slightly longer than claw 5 but narrower.

*Bellonci Organ* (Figure 3*f,g*): Broad proximally and tapering to point distally.

*Eyes:* Lateral eye small faint, with 3 or 4 light amber ommatidia; area surrounding ommatidia either colorless or brown; medial eye unpigmented (Figure 3*f–h*).

*Upper Lip* (Figure 3*f*): Unpaired anterior lobe with fairly large glandular openings; paired posterior lobes with smaller proximal paired lateral lobes; each lateral lobe with about 5 glandular openings.

*Genitalia* (Figure 3*i*): Oval ring with attached spermatophore.

*Anterior of Body* (Figure 3*f*): Prominent dome-like process present between medial eye and upper lip.

*Posterior of Body:* Evenly rounded.

Y-*Sclerite* (Figure 3*i*): Typical for subfamily.

*Eggs:* USNM 157974 with 1 large egg in marsupium and many smaller unextruded eggs; USNM 158584 with 4 eggs in marsupium. Holotype with 16 eggs. USNM 193167C, 3 specimens with 9, 9, and 3 eggs.

DESCRIPTION OF MALE ADULT (Figures 5, 6).—Carapace similar in shape to that of female except for more strongly produced caudal process. Male generally smaller than female.

*Infold:* Infold behind rostrum with 9 long bristles and several smaller bristles; 2 long bristles at inner end of incisur; 1 bristle near inner margin of infold ventral to inner end of incisur, anteroventral infold with 22 bristles forming row along list; several small bristles forming row inward from list bristles; posterior edge of list of caudal process with numerous minute processes; 16 small bristles forming row along list of caudal process; outer edge of caudal process with about 18 pores.

*Selvage:* Similar to that of female.

*Size:* USNM 193167A, length 1.99 mm, height 1.34 mm; USNM 293167B, 4 specimens: length 2.06 mm, height 1.30 mm, length 2.19 mm, height 1.38 mm, length 2.00 mm, height 1.36 mm, length 2.00 mm, height 1.33 mm.

*First Antenna* (Figure 5*b*): Joints 1–6 similar to those of female. 7th joint: a-bristle slender, about twice length of bristle of 6th joint; b-bristle about 2½ times length of a-bristle, with stout proximal filament (with marginal sucker having about same diameter as proximal bulge of filament, and with small protuberance near pointed tip of filament), followed by 2 slender filaments (each with 2 small suckers forming row), followed by 2 small bare marginal filaments (tips with minute

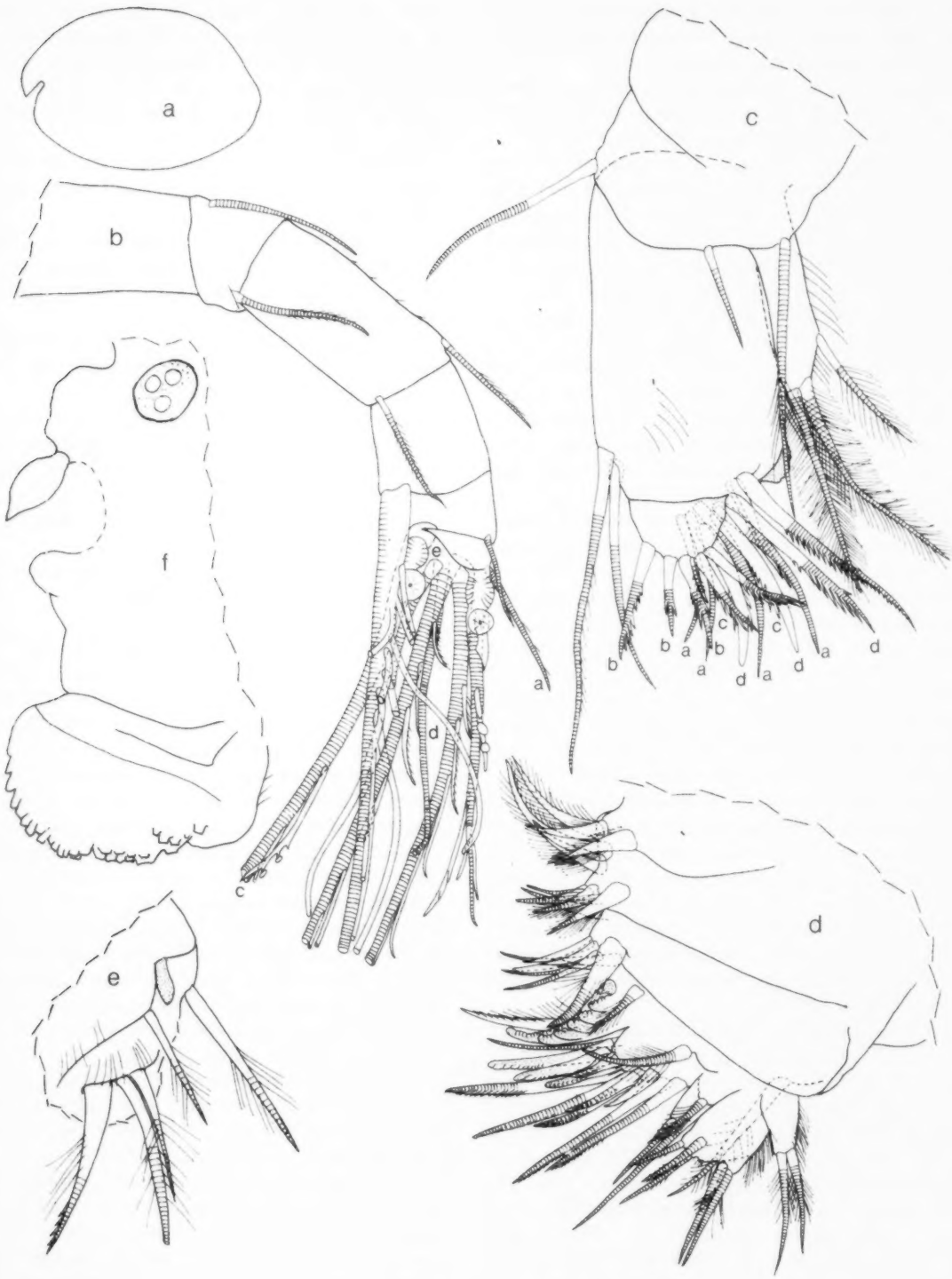



FIGURE 5.—*Paradoloria lippa*, new species, adult male, paratype, USNM 193167A: *a*, complete specimen from left side, length 1.99 mm; *b*, left 1st antenna, medial view; *c*, maxilla; *d*, right 5th limb, posterior view; *e*, part of left 5th limb, anterior view; *f*, anterior of body showing left lateral eye, medial eye and Bellonci organ, upper lip, and anterior process.

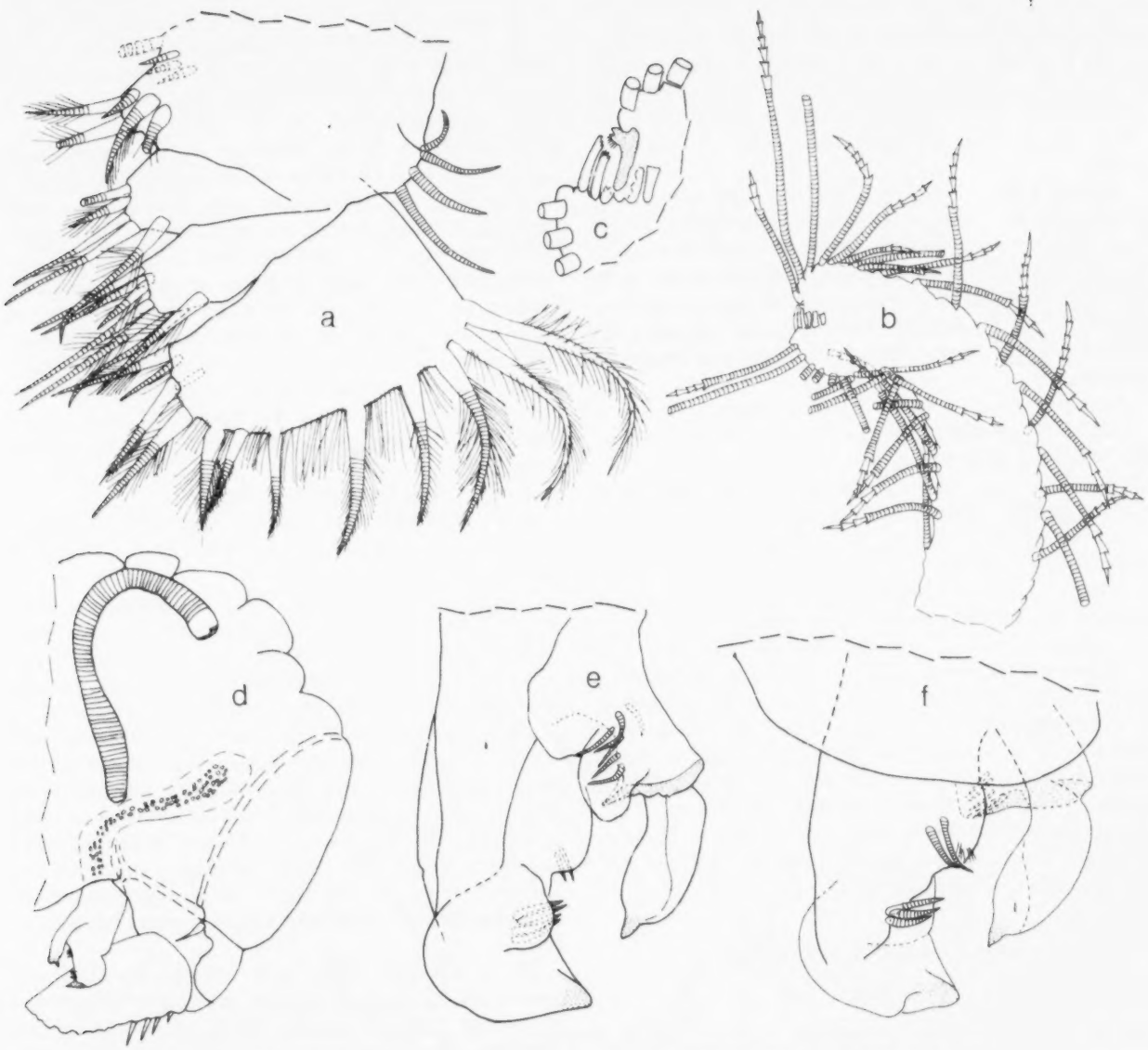



FIGURE 6.—*Paradoloria lippa*, new species, adult male, paratype, USNM 193167A: *a*, right 6th limb, medial view; *b*, 7th limb; *c*, detail of tip of 7th limb in *b*; *d*, posterior of body showing stem of 7th limb (bristles not shown), left copulatory organ, left lamella of furca (only 4 proximal claws shown), and dashed Y-sclerite and girdle; *e,f*, copulatory organs.

spine); tip of b-bristle with minute spine; c-bristle about 1/3 longer than sensory bristle of 5th joint, with stout proximal filament (with sucker larger than that of proximal filament of b-bristle, and with small protuberance near pointed tip), followed by 2 or 3 proximal filaments, each with 2 small suckers forming row (only 1 proximal filament shown on illustrated limb), followed by 5–7 short slender filaments (slender filaments and tip of bristle with minute terminal spine). 8th joint: d- and e-bristles shorter than b-bristle, bare with blunt tips (distal ends of bristles broken on illustrated limb); f-bristle slightly shorter than c-bristle, with 8 short slender marginal filaments, some with ventral spines; g-bristle about same length as c-bristle, with 10 or 11 marginal filaments, some with ventral spines.

*Second Antenna, Mandible, Maxilla* (Figure 5*c*): Similar to those of female.

*Fifth Limb* (Figure 5*d,e*): Endites I and II each with 6 spinous bristles; endite III with 7 spinous, bare or pectinate

bristles. Protopodite and exopodite similar to those of female.

*Sixth Limb* (Figure 6*a*): 4 bare epipodial bristles. Endite I with 3 short medial bristles and 1 long terminal bristle; endite II with 2 or 3 short medial bristles and 1 or 2 longer terminal bristles; endite III with 5 bristles; endite IV with 6 or 7 bristles. End joint with 13 bristles (posterior 2 hirsute to tip, others with either long proximal and short distal spines or only short spines).

*Seventh Limb* (Figure 6*b,c*): Comb side with 17–19 bristles; peg side with 16–19 bristles; total bristles 33–38; each bristle with up to 5 bells. Terminal comb with about 12 teeth (3 short blunt teeth on each side, and 6 curved teeth along middle part); minute sclerotized peg (with faint spines along inner side) present opposite comb (peg part of sclerotized process at middle of tip of limb (Figure 6*b,c*); peg obscure on some limbs).

*Furca* (Figure 6*d*): Similar to that of female.

*Bellonci Organ, Medial and Lateral Eyes, Upper Lip* (Figure 5*f*): Similar to those of female.

*Genitalia* (Figure 6*d–f*): Copulatory limb on each side of body comprising 2 main lobes, each with sclerotized tip.

*Anterior of Body* (Figure 5*f*): Rounded protuberance similar to that of female.

*Posterior of Body* (Figure 6*d*): Posterodorsal margin scalloped (not smoothly rounded as in female).

Y-*Sclerite* (Figure 6*d*): Typical for subfamily.

COMPARISONS.—The appendages and carapace of *Paradoloria lippa* closely resemble those of *P. dorsoserrata*. The lateral eyes of *P. lippa* are smaller than those of *P. dorsoserrata* and have only 3 or 4 ommatidia compared to over 30 for *P. dorsoserrata*. The anterior of the body of *P. lippa* bears a rounded protuberance between the medial eye and upper lip; this protuberance is bifurcate on *P. dorsoserrata*. The carapace of *P. lippa* is smaller than that of *P. acorensis* and the furca has fewer claws (11 compared to 12).

### *Paradoloria magna*, new species

FIGURES 7, 8

*Paradoloria*, species B.—Kornicker, 1985:410–411.

ETYMOLOGY.—From the Latin *magnus* (large, great), in reference to the size of the carapace.

HOLOTYPE.—Stage and sex not known with certainty, probably an A-1 female, on slide and in alcohol, MNHN Os 145, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS III, R.V. *Jean Charcot*, west of Bay of Biscay, 47°32′42″N, 8°36′30″W, 2147 m, sta 1, sample DS-36, 24 Aug 1973.

PARATYPES.—BIOGAS I, sta Hors-Zone: sample DS-14, 1 specimen at same stage of development and sex as holotype plus 7 earlier instars, MNHN Os 146–147.

DISTRIBUTION.—West of Bay of Biscay, 1560–2147 m.

DESCRIPTION (See "Remarks," page 000, for estimated stage of development and sex) (Figures 7, 8).—Carapace smooth, oval in lateral view with caudal process only slightly distinguished from shell contour by slight concavity at its dorsal end (Figure 7*d*); tip of rostrum pointed and overlapping shell margin (Figure 7*a*).

*Infold* (Figure 7*a–c*): Broad in area of rostrum, caudal process, and ventral to incisur, narrow elsewhere; infold behind rostrum with 17 bristles (some long, divided, others small, undivided); 2 long divided bristles at inner end of incisur; 1 small bristle present posterior to inner end of incisur, and 1 bristle near outer margin of infold ventral to inner end of incisur; anteroventral infold with about 25 divided bristles; list between valve midlength and ventral end of caudal process with about 15 bristles forming row; posterior edge of list of caudal process with numerous minute processes (Figure 7*c*); many small bristles forming row along list of caudal process; outer edge of caudal process with small pores forming row (Figure 7*c*).

*Selvage:* Similar to that of *P. lippa*.

*Size:* Holotype, length 3.21 mm, height 2.09 mm; paratype from BIOGAS I, sample DS-14, lenth 3.24 mm, height 2.00 mm.

*First Antenna* (Figure 7*e*): Joints 1–4 similar to those of *P. lippa*. Sensory bristle of 5th joint with 7 long proximal filaments, 3 slender distal filaments, and bifurcate tip. 6th joint with short medial bristle with few marginal spines. 7th joint: a-bristle almost twice length of bristle of 6th joint, with few marginal spines; b-bristle almost twice length of a-bristle, with 4 short filaments, some with marginal spines; c-bristle very long, with about 9 slender filaments (some with spines) and bifurcate tip. 8th joint: d- and e-bristles more than twice length of a-bristle, bare with blunt tips; f-bristle about same length as c-bristle, with about 6 slender filaments (some with spines) and bifurcate tip; g-bristle slightly longer than c-bristle, with 8 slender filaments (some with marginal spines) and bifurcate tip.

*Second Antenna* (Figure 8*a,b*): Protopodite with small spinous medial bristle. Endopodite of paratype and right limb of holotype 2-jointed (minute segment at base of terminal filament could be interpreted as incipient 3rd joint): 1st joint with 3 proximal bristles (2 short, 1 longer) and 1 long distal bristle; 2nd joint with long terminal filament. Endopodite of left limb of holotype aberrant, 2-jointed (incipient 3rd joint absent): 1st joint similar to that of right limb; 2nd joint with 2 long terminal filaments. Exopodite: bristle of 2nd joint reaching 9th joint, with about 38 ventral spines and about 30 slender dorsal spines along full length of bristle except near tip (small segment at tip with closely spaced rings); bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 4 bristles (2 long, 1 medium, 1 short), all with natatory hairs (ventral hairs more closely spaced and thicker than dorsal hairs), no spines; joints 3–8 with basal spines increasing in length distally; spine of 8th joint reaching just past distal end

FIGURE 7.—*Paradoloria magna*, new species, A-1? female, paratype, inside views, length 3.24 mm: *a*, anterior showing bristles of infold; *b*, caudal process; *c*, detail from *b* showing processes of list. Probably A-1 female, holotype, MNHN Os 145: *d*, complete specimen from right side, length 3.21 mm; *e*, right 1st antenna, medial view, d- and e-bristles not shown; *f*, right mandible, medial view; *g*, right lamella of furca.

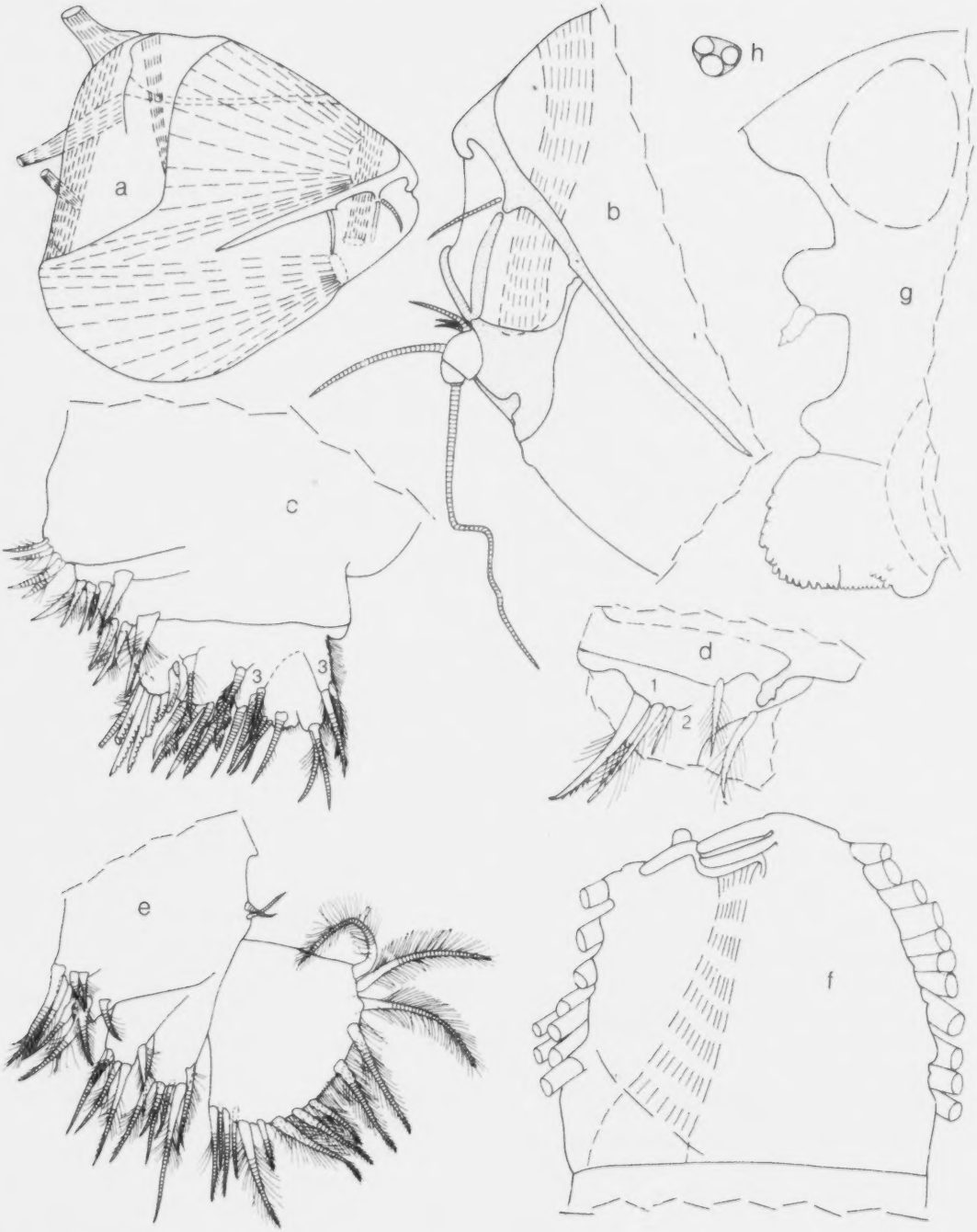



FIGURE 8.—*Paradoloria magna*, new species, A-1? female, holotype, MNHN Os 145: *a*, protopodite of left 2nd antenna showing sclerites and muscles, medial view; *b*, distal part of protopodite and endopodite, medial view; *c*, right 5th limb, posterior view; *d*, part of left 5th limb, anterior view; *e*, right 6th limb, medial view; *f*, tip of 7th limb; *g*, anterior of body showing outline of heart (dashed circle), medial e ye and Bellonci organ, anterior process, and upper lip; *h*, lateral eye.

of 9th joint; lateral spine of 9th joint about 1/4 longer than length of 9th joint.

*Mandible* (Figure 7*f*): Spinous coxale endite with 2 stout terminal spines having small peg between them; small ringed bristle near base of endite. Basale: Ventral margin with 2 or 3 a-bristles, 1 b-bristle about half way between a- and c-bristles, 2 c- and 2 d-bristles; dorsal margin of basale with 2 midbristles and 2 terminal bristles; medial side with few distal hairs. 1st endopodial joint with 4 ventral bristles (2 long, 2 short), all except smallest bristle with marginal spines; dorsal margin with few terminal spines. 2nd endopodial joint: medial side with faint spines forming row; ventral margin with spines and 4 slender unringed bristles forming groups of 1, 1, and 2 bristles (medial bristle of distal pair about same diameter and length as lateral bristle): dorsal margin with 7 or 8 medium and long bristles with short marginal spines and 3 or 4 short cleaning-type bristles with long marginal spines (marginal spines of bristles not all shown on illustrated limb). Bristles of end joint and exopodite similar to those of *Paradoloria lippa*.

*Maxilla:* Endite I with about 11 spinous bristles; endite II with 7 spinous bristles; endite III with 1 proximal and about 6 distal bristles. Coxale with dorsal fringe of long hairs and 1 stout dorsal bristle with long proximal and short distal hairs. Basale with 3 terminal bristles (1 dorsal, 1 medial, 1 ventral, spinous). Exopodite hirsute, with 3 bristles (1 proximal with long proximal hairs, 2 terminal with long hairs on posterior bristle and short hairs on anterior bristle). 1st endopodial joint with dorsal hairs, 2 alpha-bristles (proximal bristle longer and with faint marginal hairs, other bristle bare), and 3 beta-bristles (posterior bristle longest and pectinate, other bristles bare); cutting tooth with 3 or 4 low rounded processes. 2nd endopodial joint with 4 a-bristles (all with just a few, minute, proximal spines); 3 pectinate b-bristles, 3 c-bristles (anterior bristle ringed and with small spines, posterior 2 bristles claw-like, pectinate) and 3 stout pectinate d-bristles. Relative proportions of joints similar to those of *P. lippa*.

*Fifth Limb* (Figure 8*c*,*d*): Protopodite with elongate tooth with undulate outer edge. Endite I with 4 spinous bristles; endite II with 5 spinous bristles; endite III with 7 spinous bristles (not all shown on illustrated limb), and 1 spinous anterior bristle near tooth of protopodite (Figure 8*d*). 1st exopodial joint: main tooth with smooth triangular peg and 5 constituent teeth; 1 spinous bristle proximal to peg; 3 bristles of anterior group spinous (inner bristle stouter than others and pectinate distally). 2nd exopodial joint: with 11 pectinate a-and b-bristles; c-bristle with long hairs; d-bristle with long proximal and short distal hairs. 3rd exopodial joint with 3 bristles on inner lobe and 2 on outer hirsute lobe. 4th exopodial joint with 4 bristles and low hirsute rounded process near 5th joint. 5th exopodial joint with 2 terminal bristles. Epipodial appendage with 57 bristles.

*Sixth Limb* (Figure 8*e*). Endite I with 2 short medial and 2 long terminal bristles; endite II with 2 short medial bristles, 2 terminal bristles, and 1 minute bristle medial to dorsal terminal bristle; endite III with 1 medial bristle, 3 terminal bristles, and 1 short bristle medial to dorsal terminal bristle; endite IV with 1 medial bristle and 5 terminal bristles. End joint with 14 bristles (posterior 3 hirsute to tip, others with only short spines, or hirsute proximally and with short spines near tip). Two bare bristles in place of epipodial appendage.

*Seventh Limb* (Figure 8*f*): Comb side with 21 or 22 bristles, peg side with 20 or 21 bristles; total bristles 42 or 43; each bristle with up to 4 bells; proximal bristles slightly tapering and with only 1 bell (juvenile character?). Terminal comb obscure on both limbs of specimen studied but with about 6 elongate teeth (only 2 shown on illustrated limb); minute sclerotized peg opposite comb (peg part of sclerotized process at middle of tip of limb).

*Furca* (Figure 7*g*): Each lamella with 10 claws; claw 4 longer than claw 5 but slightly narrower.

*Bellonci Organ* (Figure 8*g*): Cylindrical with small triangular apex.

*Eyes* (Figure 8*g*,*h*): Lateral eye of holotype reddish brown, small, with 3 faint ommatidia; lateral eye of paratype with numerous small cells, faint. Medial eye unpigmented.

*Upper Lip* (Figure 8*g*): Similar to that of *P. lippa*.

*Genitalia:* None observed.

*Anterior of Body* (Figure 8*g*), *Posterior of Body*, *Y-Sclerite:* Similar to those of *P. lippa*.

COMPARISONS.—*Paradoloria magna* differs from *P. lippa* in having a much larger carapace (length 3.21–3.24 mm compared to 1.99–2.36 mm); also, in having fewer cleaning-type bristles on the 2nd endopodial joint of the mandible (3 or 4 compared to 11), and fewer claws on each lamella of the caudal furca (10 compared to 11), but these differences could be due to *P. magna* being a juvenile.

REMARKS.—The absence of genitalia as well as the presence of tapering proximal bristles having only 1 distal bell on the 7th limb of both specimens studied suggest that they are juveniles, probably 5th instars (A-1). If so, it is possible that the number of cleaning-type bristles on the 2nd endopodial joint of the mandible and the number of claws on the furca are greater on the adult. Neither specimen showed signs of molting such as the new appendage being visible within the old. The absence of buds representing the male copulatory appendage suggests that both specimens are female.

### *Hadacypridina* Poulsen, 1962

TYPE SPECIES.—*Hadacypridina bruuni* Poulsen, 1962:230 by monotypy.

DISTRIBUTION.—The genus was previously known from the vicinity of New Zealand at depths of 5340–6000 m (Poulsen, 1962:230; Kornicker, 1975a:126). The new species described herein is from west of the Bay of Biscay at depths of 3250–4550 m.

COMPOSITION.—The genus comprises 2 species, *H. brunni*

Poulsen, and the new species *H. biscayensis*, described herein.

### *Hadacypridina biscayensis*, new species

FIGURES 9–11

*Hadacypridina* species A.—Kornicker, 1985:410–412.

*Metavargula* species A.—Kornicker, 1985:410–412 [only specimen from sample DS-60].

ETYMOLOGY.—Named after Bay of Biscay near where the specimens were collected.

HOLOTYPE.—Ovigerous female on slide and in alcohol, MNHN Os 93, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS IV, R.V. *Jean Charcot*, west of Bay of Biscay, 47°26′48″N, 9°07′12″W, 3742 m, sta 2, sample DS-60, 24 Feb 1974.

PARATYPES.—BIOGAS V, R.V. *Cryos*, sta 4: sample DS-68, 1 juvenile (instar III) MNHN Os 92. BIOGAS VI, R.V. *Jean Charcot*, sta 2: sample DS-75, 1 adult female, MNHN Os 91.

DISTRIBUTION.—West of Bay of Biscay at abyssal depths, 3250–4550 m.

DESCRIPTION OF ADULT FEMALE (Figures 9–11*c*).—Carapace oval in lateral view with narrow rostrum and narrow caudal process (Figures 9*a–d*, 11*a,b*); anterior of rostrum linear and forming point with incisur. Lateral surface of carapace smooth, but anterior margin near ventral curvature with minute serrations.

*Infold* (Figures 9*b–d*, 11*a,b*): Rostral infold with 10 small bristles; paired bristles at inner end of incisur (Figure 9*b*); 3 minute bristles posterior and ventral to incisur; list narrow, with anterior end about midway between incisur and ventral margin of valve, continuing posteriorly just within ventral margin, increasing distance from shell margin at posterior end, forming anterior margin of caudal process (Figure 9*c,d*); ridge bearing lamellar prolongation present along posterior edge of incisur increasing distance from shell edge at about anterior end of list and continuing just within shell edge, terminating at posterior corner of tip of caudal process; lamellar prolongation of selvage broad in vicinity of incisur, narrow elsewhere; list of caudal process of right valve forming broad process (Figures 9*c*, 11*a,b*); 1 or 2 minute bristles on infold of caudal processes and additional minute bristles along list of caudal process (Figure 9*c,d*); about 25 small bristles forming row just distal to list of anteroventral and ventral margins of each valve.

*Central Adductor Muscle Attachments:* Consisting of numerous oval individual scars.

*Size:* Holotype, length 2.52 mm, height 1.80 mm, height 72% of length; MNHN Os 91 length 2.46 mm, height not measured.

*First Antenna:* 1st and 2nd joints bare. 3rd joint with 2 bristles, 1 ventral, 1 dorsal. 4th joint with 2 terminal bristles, 1 ventral, 1 dorsal. Sensory bristle of 5th joint with 8 long proximal filaments and short, slender, distal filaments. Medial bristle of 6th joint about same length as combined joints 7 and 8. 7th joint: a-bristle stouter but about same length as bristle of 6th joint; b-bristle slightly longer than a-bristle, with 4 short marginal filaments; c-bristle about 1/4 longer than sensory bristle of 5th joint, with 8 or 9 short filaments. 8th joint: well defined; bare d- and e-bristles about 3 times length of a-bristle; f-bristle about same length as sensory bristle of 5th joint, with 8 or 9 short filaments, some with marginal spines; g-bristle longer than f-bristle (tip missing on specimen examined and with 9 short filaments, some with marginal spines, on remaining part).

*Second Antenna* (Figure 9*e*): Protopodite with short medial bristle. Endopodite 2-jointed: 1st joint with 3 short and 2 longer bristles (distal of latter with marginal spines); distinct 2nd joint with 2 terminal bristles (1 short, 1 long). Exopodite: bristle of 2nd joint reaching joints 7 or 8, with 12 ventral spines (10th spine stouter than others, proximal spines and last 2 spines more slender than others); bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 4 bristles (1 short, bare, or with short spines; 1 longer with natatory hairs, 2 very long with natatory hairs); joints 3–8 with very small basal spines; lateral spine of 9th joint about half length of joint and with marginal spine near tip.

*Mandible* (Figure 9*f*): Coxale endite spinous, with 2 terminal spines but no peg; small bristle at base of endite. Basale: ventral margin with 2 small unequal a-bristles, 1 small b-bristles, 2 c-bristles (1 short, 1 longer), and 2 d-bristles (1 short, 1 very long with wreaths of long hairs); dorsal margin with 3 bristles (1 distal to middle, 2 terminal). Exopodite about 2/3 length of dorsal margin of 1st endopodial joint, hirsute distally and with 2 bristles (distal about 1/3 length of other). 1st endopodial joint with 4 ventral bristles (2 short, 2 long). 2nd endopodial joint: ventral margin with single, small, pointed bristle and a terminal pair of slender pointed bristles (medial slightly stouter, unringed, and with marginal spine near tip); dorsal margin with 6 medium-to-long bristles and 6 short spinous bristles; medial surface with spines forming rows. 3rd joint with 2 stout claws, 2 ventral bristles (1 same length as claws, 1 shorter), and 2 short dorsal bristles (illustrated limb aberrant in having no claws and only 3 bristles).

*Maxilla* (Figure 10*a*): Thin epipodial appendage with faint hairs. Coxale with stout, plumose, dorsal bristle. Endite I with 7 spinous bristles (3 with knife-like tips, 2 with bifurcate tips, none with marginal teeth); endite II narrower than endite I, with 5 spinous bristles; endite III narrower than endite II, with 4 bristles (3 stout spinous, 1 slender bare). Basale with 2 or 3 (1 short, 1 or 2 long) bristles along distal margin. Exopodite stout, with 3 bristles (proximal bristle and outer terminal bristle plumose, inner terminal bristle with short marginal hairs). 1st endopodial joint with stout cutting tooth with 2 cusps, short hairs along dorsal margin, 2 alpha-bristles (inner bristle with short marginal hairs, outer bristle longer and with long marginal hairs), and 2 beta-bristles (outer of these stout,

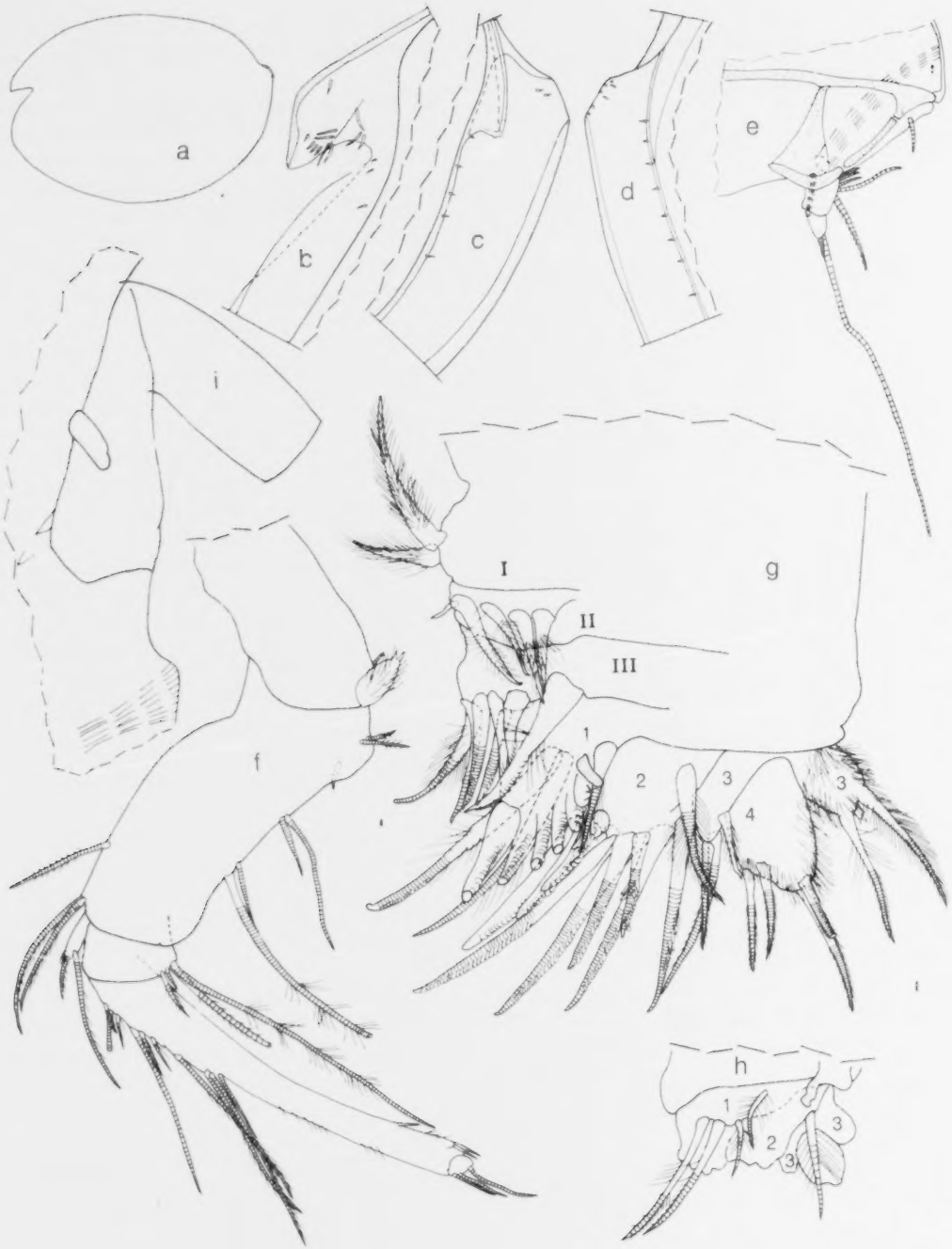



FIGURE 9.—*Hadacypridina biscayensis*, new species, ovigerous female, holotype, MNHN Os 93: *a*, complete specimen from left side, length 2.52 mm; *b*, anterior of right valve from inside showing bristles of infold; *c*, caudal process of right valve from inside; *d*, caudal process of left valve from inside; *e*, distal part of protopodite and endopodite of left 2nd antenna, medial view; *f*, right mandible, medial view; *g*, right 5th limb, posterior view; *h*, part of left 5th limb, anterior view; *i*, anterior of body showing Bellonci organ and joints 1 and 2 of left 1st antenna.

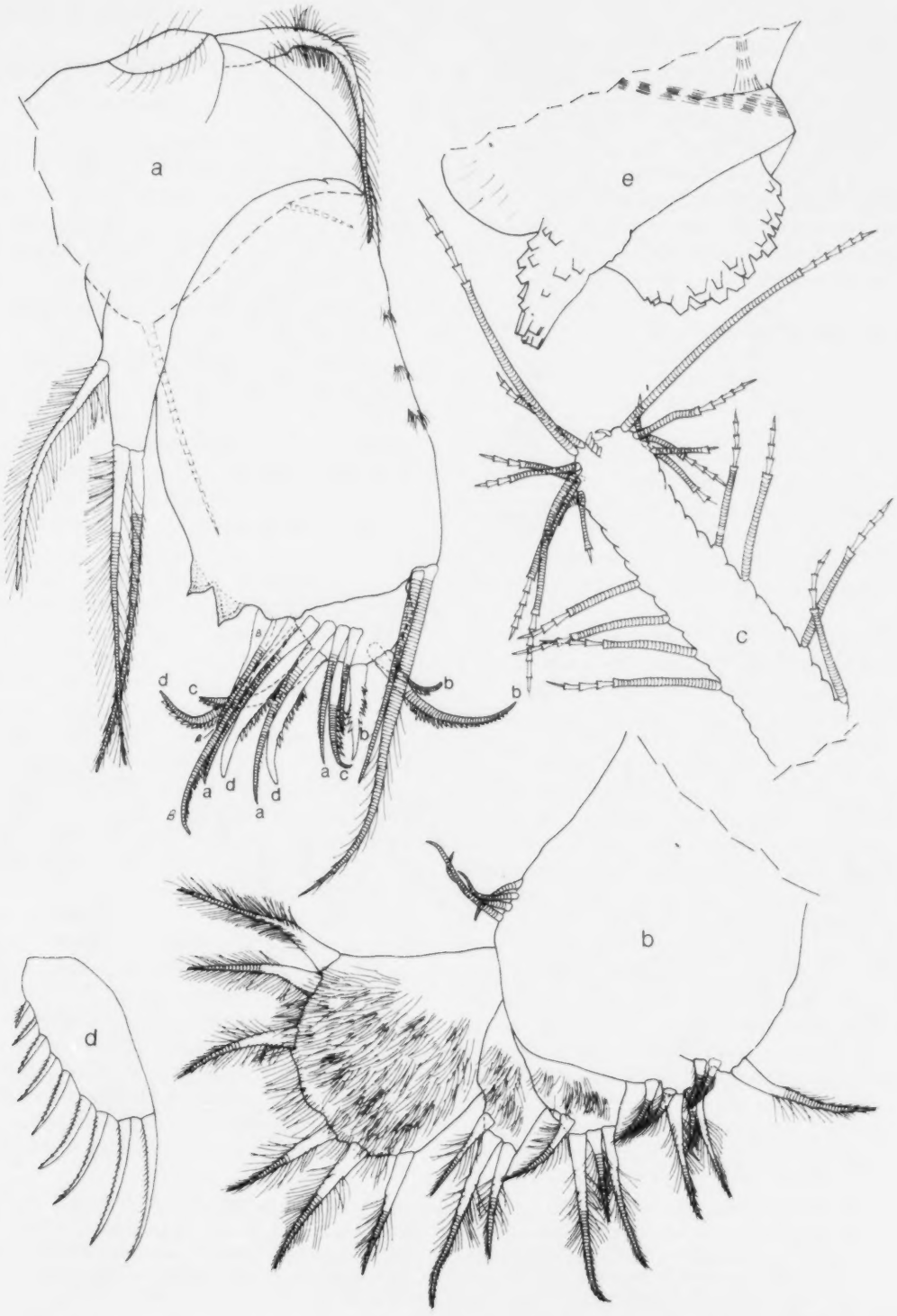



FIGURE 10.—*Hadocypridina biscayensis*, new species, ovigerous female, holotype, MNHN Os 93: *a*, maxilla, endites not shown; *b*, left 6th limb, medial view; *c*, 7th limb; *d*, right lamella of furca; *e*, upper lip.

pectinate). 2nd joint with 4 a-bristles (some with minute marginal teeth), 3 pectinate b-bristles, 2 pectinate c-bristles, and 3 pectinate d-bristles.

*Fifth Limb* (Figure 9*g,h*): Epipodial appendage with 46 bristles. 3 endites present: endite I with 5 bristles; endite II with 1 small bare bristle and 4 spinous bristles; endite III with 7 spinous or pectinate bristles. Anterior tooth of protopodite undulate (Figure 9*h*). 1st exopodial joint: anterior side with 3 bristles forming group near inner side of joint (2 inner bristles long, stout, with long proximal hairs and short distal spines; outer bristle short with long proximal hairs), and near middle of joint 1 bristle with long proximal hairs; main tooth consisting of smooth peg and 6 constituent pectinate teeth; 1 spinous bristle on posterior side proximal to peg. 2nd exopodial joint with 1 proximal posterior bristle with long proximal and short distal hairs, 4 strongly pectinate a-bristles, 3 pectinate b-bristles, and 3 pectinate b′-bristles. 3rd exopodial joint: inner lobe with 3 spinous bristles, outer lobe hirsute, with 2 bristles with long proximal and short distal hairs. Hirsute 4th and 5th exopodial joints fused, with small node representing division between joints; 2 spinous bristles on each joint.

*Sixth Limb* (Figure 10*b*): 4 bare bristles in place of epipodial appendage. Endite I with 2 hirsute medial bristles and 1 spinous terminal bristle; endite II with 3 hirsute medial and 2 spinous terminal bristles; endite IV with 1 medial and 2 terminal spinous bristles. End joint with 3–7 anterior bristles with long proximal and short distal spines followed by space and 3 or 4 bristles (1 or 2 with long proximal and short distal spines, and 2 posterior, hirsute). Endites III and IV and end joint hirsute. (Holotype with 6 bristles on end joints of both limbs; paratype with 8 bristles on 1 limb and 10 on other.)

*Seventh Limb* (Figure 10*c*): Proximal group with 8 bristles (4 on a side) each with 4 bells; terminal group with 8 bristles on comb side and 6 bristles on peg side, each with 1–5 bells. Comb indistinct but with about 7 short straight teeth; peg opposite comb recurved.

*Furca* (Figure 10*d*): Each lamella with 9 claws decreasing gradually in length posteriorly, all separated from lamella by distinct suture; teeth along posterior margin of claws having similar length; right lamella slightly anterior to left.

*Bellonci Organ* (Figure 9*i*): Small, elongate.

*Eyes:* Lateral eyes absent. Medial eye not seen.

*Upper Lip* (Figure 10*e*): Consisting of unpaired anterior part with fairly large glandular processes, and paired tusks with large glandular processes; posterior lobe hirsute.

*Genitalia:* Oval sclerotized ring with attached round spermatophore on each side of body anterior to furca.

*Posterior of Body:* Bare and without processes.

Y-*Sclerite:* Typical for Cypridininae.

*Eggs:* Holotype with 14 eggs in marsupium.

DESCRIPTION OF JUVENILE (instar III) (Figure 11*d–f*).—Carapace similar in outline to that of adult female (Figure 11*d*).

*Infold:* In general, similar to that of adult female but with fewer bristles.

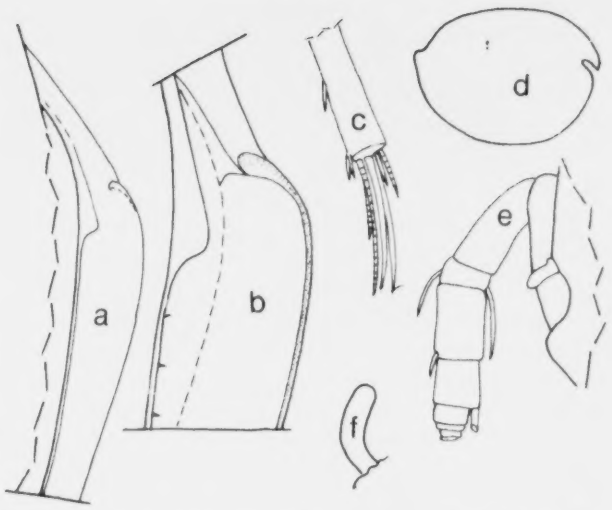



FIGURE 11.—*Hadocypridina biscayensis*, new species, adult female, paratype, MNHN Os 91, length 2.46 mm: *a*, caudal process of right valve, inside view, bristles not shown; *b*, detail from *a*; *c*, tip of right mandible, lateral view. Instar III, paratype, MNHN Os 92: *d*, complete specimen from right side, length 1.30 mm; *e*, anterior of body showing Bellonci organ and part of right 2nd antenna; *f*, 7th limb.

*Size:* Length 1.30 mm, height 0.93 mm, height 72% of length.

*First Antenna* (Figure 11*e*): 1st and 2nd joints bare. 3rd joint with 1 ventral bristle on left limb, and 2 bristles (1 ventral, 1 dorsal) on right limb. 4th joint with short dorsal bristle. Sensory bristle of 5th joint with 4 long proximal filaments and 1 short distal filament. 6th joint with small medial bristle; a–g bristles of joints 7 and 8 present but not examined in detail.

*Second Antenna:* Protopodite with small distal medial bristle. Endopodite 2 jointed (similar to that of adult female): 1st joint with 1 anterior bristle; 2nd joint with 2 terminal bristles (1 long, 1 minute). Exopodite 9-jointed: bristle of 2nd joint reaching 8th joint, with ventral spines; bristles of joints 3–8 with natatory hairs; 9th joint with 3 bristles (1 short, bare, 2 long with natatory hairs).

*Mandible:* Right mandible aberrant, without 2nd and 3rd endopodial joints: 1st joint with 2 long terminal bristles. Left mandible similar to that of adult female paratype except ventral margin of 2nd endopodial joint with only 3 bristles (2 long, 1 short) and ventral margin of 3rd joint with 3 bristles; number of dorsal bristles on 2nd joint not counted.

*Maxilla, Fifth Limb, Sixth Limb:* Well developed but not studied in detail.

*Seventh Limb* (Figure 11*f*): Small, bare.

*Furca:* Each lamella with 5 claws, all separated from lamella by well-defined suture.

*Bellonci Organ* (Figure 11*e*): Small, and poorly defined.

*Eyes:* Medial eye if present, without pigment and not well defined. Lateral eyes absent.

*Upper Lip, Y-sclerite, Posterior of Body:* Similar to those of adult female. Posterior of body without dorsal process or spines.

REMARKS.—I could not ascertain whether or not the caudal process of this species terminates in an open tube like that of the type species (Poulsen, 1962, fig. 109a). The dorsal end of the caudal process of the holotype of *H. biscayensis* seems to end with a sharp edge (Figure 9*c,d*) that could be the edge of a tube, but the same edge of the adult paratype bears an elongate structure on the right valve (posterior end of left valve missing) that could not be interpreted as the end of a tube (Figure 11*a,b*). The tip of the caudal process of the juvenile did not have the process that is present on the adult paratype, but the edge appears thicker than that of the holotype. It may be that the edge of the tip of the caudal process of the holotype is missing. If so, the shell of this specimens is without a caudal siphon, but the study of more specimens is necessary to resolve the issue.

COMPARISON.—The new species, *H. biscayensis*, is smaller than *H. bruuni* (length of adult female 2.46–2.52 mm compared to 3.60 mm). The end joint of the 6th limb of the new species is not as broad as that of *H. bruuni* and has fewer bristles (6–10 compared to 13). The posterior lobes of the upper lip of *H. biscayensis* do not have the teeth present on the unique female described by Poulsen (1962:234); teeth are also absent on the juvenile male referred to *H. bruuni* by Kornicker (1975a:126). The latter specimen has a longer caudal process than that of *H. biscayensis*.

### *Metavargula* Kornicker, 1970

TYPE SPECIES.—*Metavargula ampla* Kornicker, 1970:3

DISTRIBUTION.—Widespread, especially in deep water and cold regions; the southernmost record is in the Weddell Sea (72°47′30″S, 30°28′18″W) and the northernmost record is west of the Bay of Biscay. Previous known depth range of the genus was 117–3658 m. In the present study the genus was collected at depths of 1845–4240 m, slightly extending the depth at which the genus has been collected.

COMPOSITION.—Three species of *Metavargula* were collected in the study area, all new: *M. quintuplex, M. bilix*, and *M. hex*.

I herewith propose that *Cypridina nobilis* Cleve, 1905, collected at 450 m depth off South Africa (Cleve, 1905:134), be referred to *Metavargula*, as *Metavargula nobilis*, because of the broad flat filaments on the sensory bristle of the 5th joint of the male 2nd antenna (Cleve, 1905, pl. 7: fig. 4). Males of *Bathyvargula* also have flat filaments, but species of that genus seem less common than species of *Metavargula*. The referral must be considered tentative until the species is better known.

#### Key to Species of *Metavargula*

1. Height more than 70 percent of length . . . . . 2
   Height less than 65 percent of length . . . . . 3
2. Carapace longer than 3.8 mm; small lateral eyes present . . . . . ***M. mazeri***
   Carapace shorter than 3.3 mm; lateral eyes absent . . . . . ***M. bradfordae***
3. Lateral eyes present . . . . . 4
   Lateral eyes absent . . . . . 9
4. Carapace longer than 5.1 mm . . . . . 5
   Carapace shorter than 4.7 mm . . . . . 6
5. Lateral eyes large; longest of 3 proximal bristles of 1st endopodial joint of 2nd antenna longer than distal bristle; furcal lamella with 9 claws . . . . ***M. nobilis***
   Lateral eyes very small; longer of 3 proximal bristles of 1st endopodial joint of 2nd antenna about half length of distal bristle; furcal lamella with 8 claws . . . . . ***M. adinothrix***
6. Furcal lamella with 8 claws . . . . . ***M. iota***
   Furcal lamella with 9 claws . . . . . 7
7. Carapace longer than 4.3 mm; 7th limb with 17–24 bristles . . . . . ***M. ampla***
   Carapace shorter than 4.0 mm; 7th limb with about 13 bristles . . . . . 8
8. Endopodite of 2nd antenna with 4 bristles on 1st joint; comb of 7th limb with 8 elongate teeth . . . . . ***M. optilus***
   Endopodite of 2nd antenna with 5 bristles on 1st joint; comb of 7th limb with 2–4 elongate teeth . . . . . ***M. bilix***
9. Female carapace longer than 3.75 mm; longest epipodial bristle of 6th limb with marginal spines . . . . . ***M. hex***
   Female carapace shorter than 3.50 mm; longest epipodial bristle of 6th limb bare . . . . . ***M. quintuplex***

### *Metavargula quintuplex*, new species

FIGURES 12–15

*Metavargula* species A.—Kornicker 1985:410–412 [part, excluding specimens from samples DS-14 (2 specimens) and DS-36 (4 specimens) referred to *Metavargula bilix;* samples DS-48 and DS-77 referred to *Metavargula hex;* samples DS-14 (2 juveniles) and DS-76 (1 juvenile, USNM 193263) referred to *Metavargula* species indeterminate].

ETYMOLOGY.—From the Latin *quintuplex* (fivefold), in reference to the 5 pectinate teeth of the 1st exopodial joint of the 5th limb of the species.

HOLOTYPE.—Partly dissected ovigerous female in alcohol, MNHN Os 90, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS II, R.V. *Jean Charcot*, west of Bay of Biscay, 47°32′12″N, 8°05′18″W, 2138 m, Sanders dredge, sta 1, sample DS-32, 19 Apr 1973.

PARATYPES.—BIOGAS I, R.V. *La Perle*, sta 1: sample DS-05, 2 females (USNM 193166) + 26 specimens; sample DS-06, 11 specimens; sample DS-07, 1 adult male + 9 specimens; sample DS-09, 125 specimens; sample DS-11, 5 specimens; sample DS-12, 1 ovigerous female; sample DS-13, 10 specimens. POLYGAS, R.V. *Jean Charcot*, sta 1: sample DS-15, 129 specimens (USNM 193266); sample DS-17, 18 specimens (USNM 193273). Sta 6: sample DS-25, 1 early instar (USNM 193271); sample DS-26, 40 specimens (USNM 193269). BIOGAS II, R.V. *Jean Charcot*, sta 1: sample DS-32, 25 specimens. Sta 2: sample DS-31, 1 adult male. Sta Hors-Zone: sample DS-33, 9 specimens. BIOGAS III, R.V. *Jean Charcot*, sta 1: sample DS-35, 1 adult male (USNM 193165) + 8 specimens; sample DS-37, 35 specimens. Sta 2: sample DS-41, 6 specimens. Sta 6: sample DS-49, 8 specimens; sample DS-50, 62 specimens. BIOGAS IV, R.V. *Jean Charcot*, sta 1: sample DS-61, 4 juveniles; sample DS-62, 39 specimens; sample DS-63, 84 specimens; sample DS-64, 21 specimens; sample CP-01, 1 specimen. Sta 2: sample DS-60, 2 females. Sta 6: sample DS-52, 168 specimens. BIOGAS VI, R.V. *Jean Charcot*, sta 1: sample DS-71, 40 specimens; sample CP-08, 3 specimens; sample CP-08a, 5 specimens; samples CP-09, 3 specimens; sample CP-09a, 5 specimens. Sta 2: samples DS-73, 1 juvenile; sample DS-75, 1 female. Sta 6: sample DS-87, 111 specimens; sample DS-88, 1 specimen; sample CP-23a, 106 specimens; sample CP-24, 2 specimens; sample CP-24a, 36 specimens; sample Nasca-05, 1 adult male (USNM 158592A) + 82 specimens (USNM 158592B). BIOGAS VIII, R.V. *Noroit*, sta 1: sample KG-148, 3 early instars; sample KG-158, 1 specimen. BIOGAS IX, R.V. *Capricorne*, sta 1: sample CP-34, 1 female (USNM 157975) + 11 specimens. BIOGAS XI, R.V. *Jean Charcot*, sta 3: sample CP-37, 7 specimens. BIOCYAN, sta 1: sample PL-18, 1 juvenile (USNM 193276); sample PL-22, 1 specimen (USNM 193277).

DISTRIBUTION.—In and west of the Bay of Biscay, 1845–3742 m.

CORRECTION.—Kornicker (1985:411) listed a station containing only *M.* species A (= *M. quintuplex*) as NA-05(3) from a depth of 4160 m. This station should be Nasca-O5 from a depth of 1980 m.

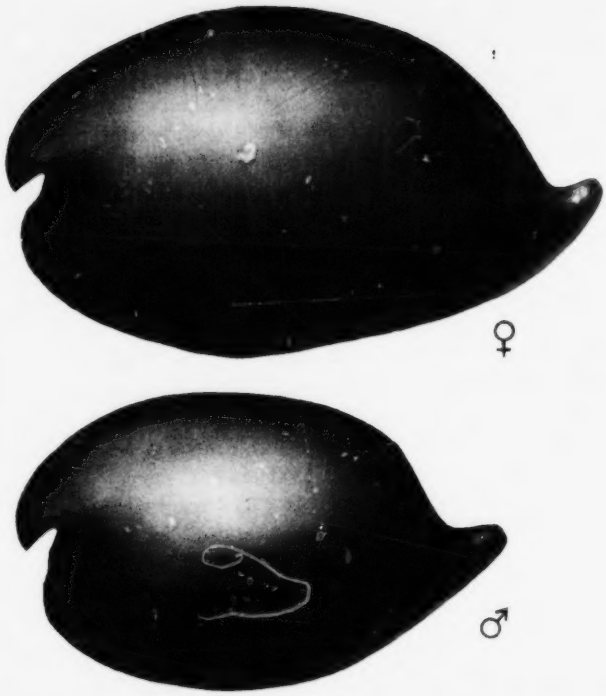



FIGURE 12.—*Metavargula quintuplex*, new species, complete carapaces of ovigerous female, holotype, MNHN Os 90, length 3.08 mm, and adult male, paratype from BIOGAS VI, sample CP-23a, length 2.53 mm.

DESCRIPTION OF ADULT FEMALE (Figures 12–14).—Carapace elongate with projecting caudal process below midheight (Figures 12, 13*c,d*); shell overlapping valve edge along anterior, anteroventral, and ventral margins (Figure 13*a–c*).

*Infold* (Figure 13*a–c*): Rostral infold with 2 bristles (1 long, 1 shorter) at inner end of incisur, 1 fairly long bristle near center of rostrum, and about 16–19 shorter bristle, mostly forming row paralleling outer edge of rostrum; anteroventral and ventral infold with 1 small bristle near inner margin just below incisur, followed by space and then 24–30 short bristles along narrow list; list extending from below incisur to caudal process; list broad anterior to caudal process, with about 10 minute bristles and 30–36 minute processes along posterior edge (Figure 13*c*); 2 or 3 minute bristles and about 5 distinct pores located on caudal process posterior to list.

*Selvage:* Lamellar prolongation of selvage broad and indistinctly striate along lower margin of incisur (Figure 13*b*), narrow along anteroventral and ventral margin of valves as well as along anterior margin of rostrum and dorsal to caudal process; selvage absent at posterior end of caudal process and along upper edge of incisur; lamellar prolongation divided at

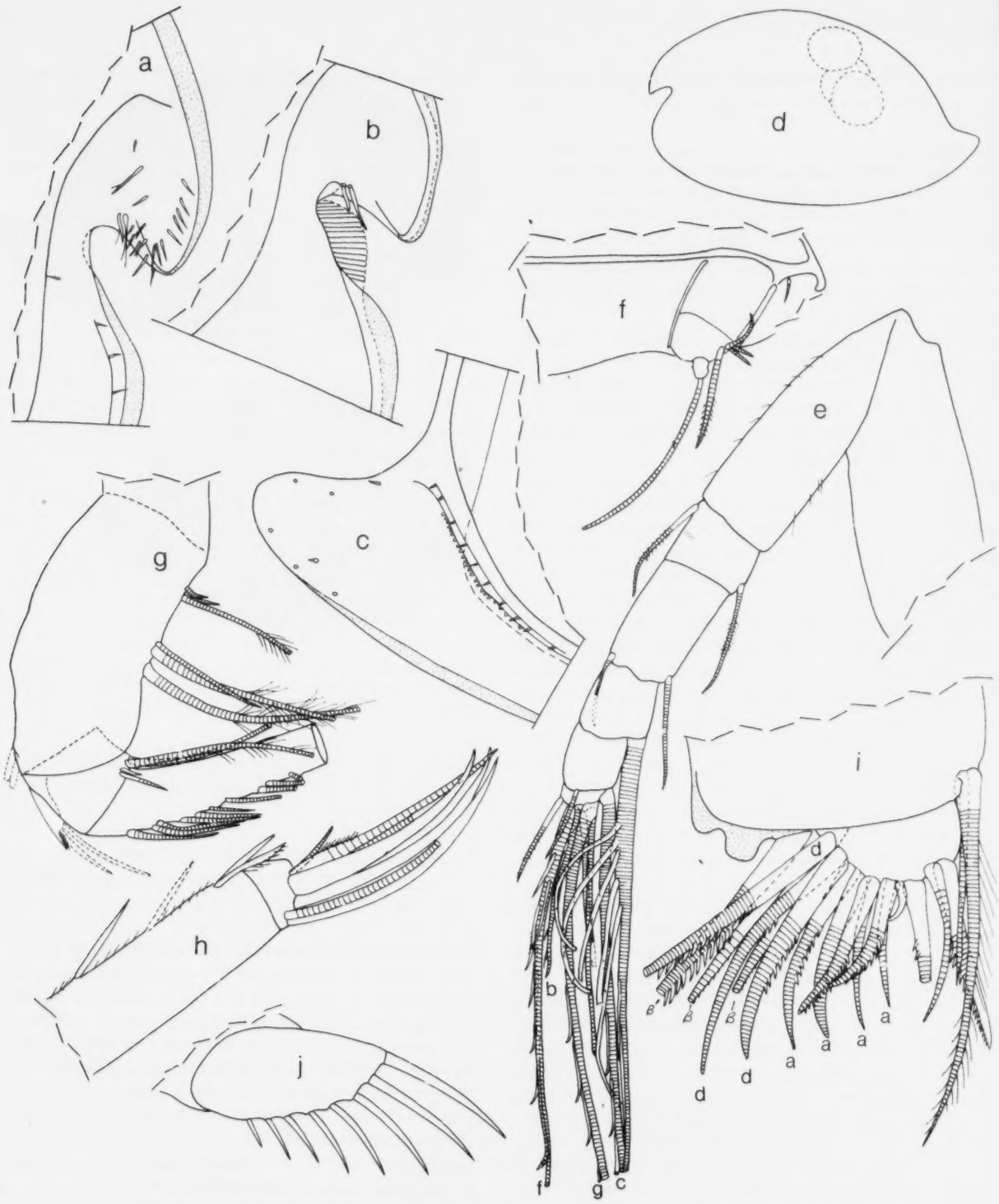



FIGURE 13.—*Metavargula quintuplex*, new species, ovigerous female, holotype, MNHN Os 90, length 3.08 mm: *a*, anterior of left valve from inside showing bristles of infold; *b*, detail from *a* showing lamellar prolongation of selvage (outer edge indicated by dashes); *c*, caudal process of left valve, inside view. Ovigerous female, paratype, USNM 157975: *d*, complete specimen from left side showing 3 eggs in marsupium, length 2.89 mm; *e*, right 1st antenna, medial view; *f*, distal part of protopodite and endopodite of left 2nd antenna, medial view; *g*, basale (aberrant ventral bristles), 1st and 2nd endopodial joints (ventral bristles not shown) of right mandible, medial view; *h*, 2nd endopodial joint (dorsal bristles not shown) and end joint of left mandible, lateral view; *i*, distal end of maxilla; *j*, right lamella of furca.

innermost end of incisur; minute length of prolongation present at innermost end of incisur extending to pair of bristles on rostrum just dorsal to inner end of incisur.

*Size:* Holotype, length 3.08 mm, height 1.81 mm. Paratypes: USNM 157975, length 2.89 mm, height 1.66 mm; USNM 193166, 2 specimens, length 2.74 mm, height 1.67 mm, length 3.04 mm, height 1.87 mm; BIOGAS I, DS-12, length 2.97 mm, height 1.86 mm; BIOGAS III, DS-41, length 2.98 mm, height 1.74 mm; BIOGAS VI, DS-71, length 3.14 mm, height 1.92 mm; BIOGAS III, DS-41, length 3.19 mm, height 1.81 mm; BIOGAS VI, CP-23a (2 specimens), length 2.91 mm, height 1.73 mm, length 3.00 mm, height 1.81 mm; BIOGAS IV, DS-60, length 3.22 mm, height 1.88 mm.

*First Antenna* (Figure 13*e*): 1st joint bare. 2nd joint with marginal spines. 3rd joint with 2 bristles (1 ventral, 1 dorsal). 4th joint with 2 bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 8 long proximal filaments (short proximal part of filaments slightly narrower than distal part) followed by 2 shorter more slender distal filaments (with minute spine at tips) and bifurcate tip. Medial bristle of 6th joint about same length as joint. 7th joint: a-bristle about same length but broader than bristle of 6th joint, with short marginal spines; b-bristle almost twice length of a-bristle, with 4 marginal filaments, some filaments with marginal spines; c-bristle longer than sensory bristle of 5th joint, with 8 marginal filaments and bifurcate tip, some filaments with marginal spines. 8th joint: d- and e-bristles about 1/3 longer than b-bristle, bare with blunt tips; f-bristle about same length as sensory bristle of 5th joint, with about 10 marginal filaments and bifurcate tip, some filaments with marginal spines; g-bristle about same length as c-bristle, with about 10 marginal filaments and bifurcate tip, some filaments with marginal spines.

*Second Antenna* (Figure 13*f*): Protopodite with short medial bristle. Endopodite 2 jointed: 1st joint with 4 bristles (2 short, 1 medium, 1 long), longest with short marginal spines; 2nd joint short, with long terminal bristle. Exopodite: 1st joint with few small spines along dorsal concave margin; joints 3–8 with basal spines increasing in length distally; basal spine of 8th joint about same length as 9th joint; 9th joint with lateral spine same length as joint; bristle of 2nd joint reaching 8th or 9th joint, with about 15 ventral spines, no hairs, distal spine longer than others; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 4 bristles (3 long, 1 short), all with natatory hairs, no spines.

*Mandible* (Figure 13*g,h*): Coxale endite spinous, with 2 stout spines and medial peg at tip, and with small bristle near base. Basale: ventral margin with 2 short a-bristles, one short b-bristle, 2 c-bristles (1 long with wreaths of long hairs, 1 short bare; short bristle close to and usually proximal to long bristle), and 2 d-bristles (short slender bristle followed by long spinous bristle); dorsal margin with 3 bristles (1 distal to middle, 2 terminal). Exopodite reaching just past distal end of 1st endopodial joint, hirsute distally, with 2 bristles on inner margin (distal of these reaching past midlength of other). 1st endopodial joint with 4 ventral bristles (1 long, 1 medium, 1 short, 1 minute). 2nd endopodial joint: dorsal margin with about 12 bristles (4 of these much longer than others); ventral margin with bristles forming 3 distal groups of 1, 1, and 2 bristles (medial of distal pair stouter than other and with spines on dorsal margin). End joint with 3 claws about same length and 4 ringed bristles (inner of these about same length as claws and slightly broader in its proximal 1/4).

*Maxilla* (Figure 13*i*): Protopodite with plumose dorsal bristle. Endite I with 11 spinous bristles; endite II with 5 spinous bristles; endite III with 5 spinous bristles. Basale with small bare bristle at inner distal edge. 1st endopodial joint with 2 alpha-bristles (outer of these long, hirsute; other slender, bare), and 3 beta-bristles (outer and middle bristle pectinate, inner small bristle bare); cutting tooth comprising 2 stout teeth. End joint: 4 a-bristles (shortest bare, others with slender marginal spines), 3 b-bristles, 3 pectinate c-bristles, and 3 d-bristles. Exopodite with 1 hirsute proximal bristle just distal to midlength and 2 terminal bristles of equal length (bristle nearest to proximal bristle hirsute, other bare).

*Fifth Limb* (Figure 14*a–c*): Protopodite with short, undulate, anterior, tooth-like process. Endite I with 7 spinous bristles; endite II with 5 bristles (1 short bare, others spinous); endite III with about 6 bristles. Exopodite: anterior side of 1st joint with 1 hirsute bristle near tooth of protopodite, and 2 stouter distal bristles (with proximal wreaths of long spines) closer to main tooth; main tooth comprising smooth triangular tooth followed by 5 pectinate teeth; 1 spinous bristle proximal to triangular tooth. 2nd exopodial joint with 4 a-bristles, 8 b-bristles, 1 c-bristle, and 1 d-bristle. 3rd joint with 3 bristles on inner lobe and 2 on outer lobe. 4th and 5th joints fused but separated by 2 small spinous nodes; 4th joint with 2 or 3 bristles, 5th joint with 2.

*Sixth Limb* (Figure 14*d*): 4 bare bristles in place of epipodial appendage. Endite I with 2 small, hirsute, medial bristles and 1 long spinous terminal bristle; endite II with 2 or 3 small hirsute, medial bristles and 2 long spinous terminal bristles; endite III with 3 long spinous terminal bristles; endite IV with 3 bristles (1 short, 2 long). End joint with 16 bristles (last 2 hirsute).

*Seventh Limb* (Figure 14*e*): Each limb with 4 or 5 (rarely as many as 8) proximal bristles with 2–5 terminal bells, and 9–12 terminal bristles with 2–4 terminal bells; terminus with 4–6 curved finger-like teeth with digitate tips and fine marginal hairs opposite finger-like process with or without digitate tip and with fine marginal hairs.

*Furca* (Figure 13*j*): Each lamella with 8 claws decreasing in size proximally along lamella; right lamella slightly anterior to left; small spines on lamellae following claws; all claws with teeth along concave margins; teeth forming medial row on claw 1 larger than teeth forming lateral row; some claws with short hairs along anterior margin.

*Bellonci Organ* (Figure 14*f*): Elongate, tapering at tip.

*Eyes:* Lateral eyes absent. Medial eye small with light

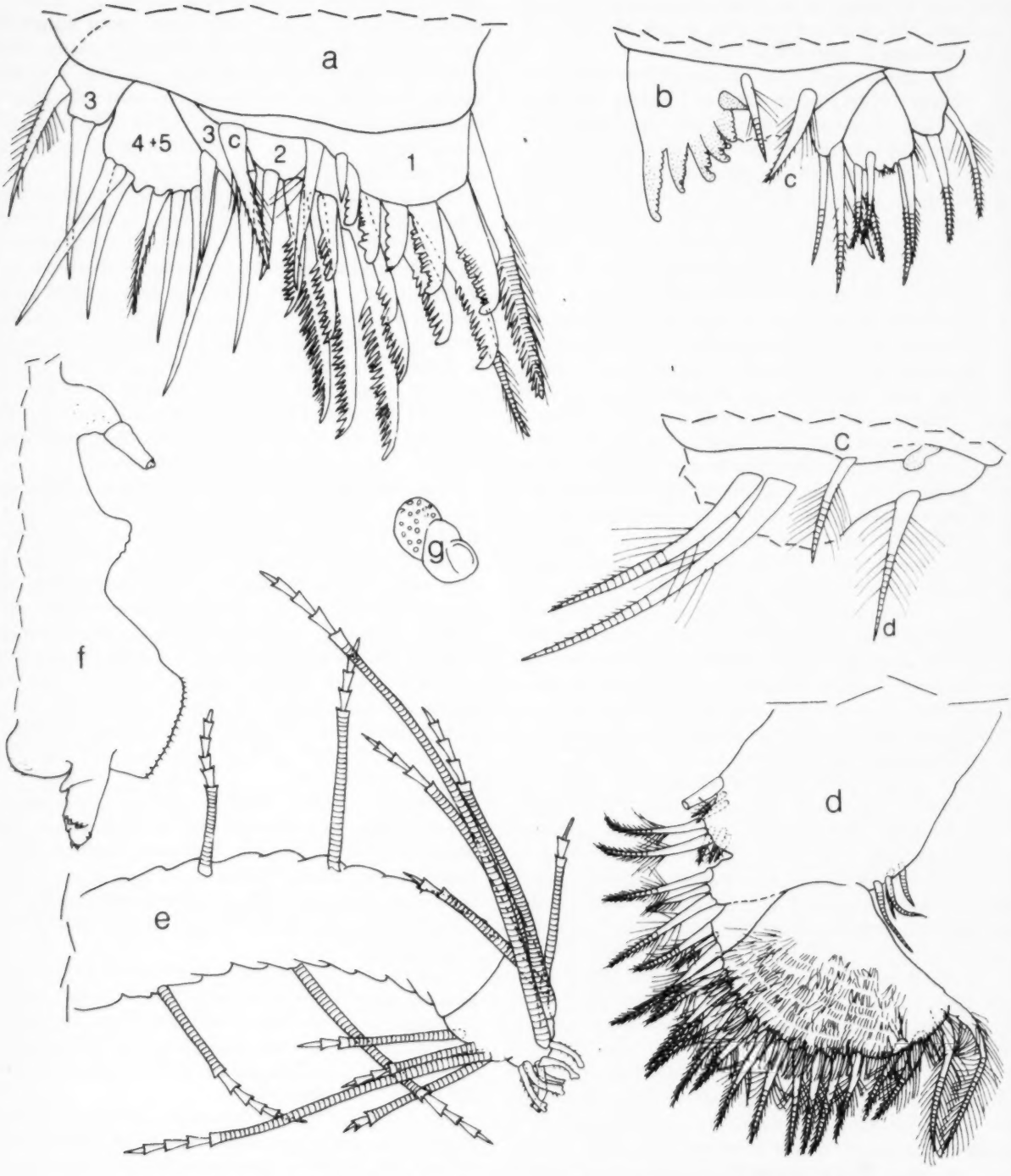



FIGURE 14.—*Metavargula quintuplex*, new species, ovigerous female, paratype, USNM 157975: *a*, left 5th limb, posterior view; *b*, part of right 5th limb, posterior view; *c*, part of left 5th limb, anterior view; *d*, left 6th limb, lateral view; *e*, 7th limb; *f*, anterior of body showing medial eye and Bellonci organ. anterior process, and upper lip; *g*, left genitalia and spermatophore.

brown pigment (Figure 14*f*).

*Upper Lip* (Figure 14*f*): Anterior part with numerous small glandular openings; paired tusks with posteriorly oriented proximal lobe; each tusk with distal and terminal glandular openings.

*Genitalia* (Figure 14*g*): Oval ring with attached spermatophore.

*Anterior of Body:* Small dome-like process present between medial eye and upper lip (Figure 14*f*).

*Posterior of Body:* Bare without process.

Y-*Sclerite:* Typical for subfamily.

*Eggs:* USNM 157975 with 3 eggs (Figure 13*d*); BIOGAS VI, DS-71, with 4 eggs; BIOGAS III, DS-41, with 11 eggs; USNM 193166 with 3 eggs; BIOGAS I, DS-12 with 2 eggs; BIOGAS II, DS-32 with 11 eggs and 2 eggs (2 specimens); BIOGAS I, DS-09 (5 specimens) with 7, 9, 9, 9, and 12 eggs.

DESCRIPTION OF ADULT MALE (Figures 12, 15).—Carapace similar in shape to that of female but smaller.

*Selvage:* Not examined in detail but similar to that of female.

*Size:* USNM 158592, length 2.38 mm, height 1.46 mm; BIOGAS VI, CP 23a, length 2.53 mm, height 1.51 mm; USNM 193165, length 2.67 mm, height 1.63 mm; BIOGAS II, DS-31, length 2.55 mm, height 1.59 mm; BIOGAS I, DS-07, length 2.48 mm, height 1.42 mm; BIOGAS VI, CP-23a, length 2.51 mm, height 1.46 mm.

*First Antenna* (Figure 15*b–d*): Joints 1–6 similar to those of female, except long proximal filaments of sensory bristle of 5th joint broad paddle-like. 7th joint: a-bristle slender, about 1/3 longer than medial bristle of 6th joint; b-bristle about 3 times length of a-bristle, with stout proximal filament (with large marginal sucker and small protuberance near pointed tip), followed by 2 slender filaments (with 3 or 4 small suckers forming row) and 1 bare filament; c-bristle longer than sensory bristle of 5th joint, with stout proximal filament (with large marginal sucker), followed by 2 slender filaments (each with 4 small marginal suckers), 4 or 5 slender filaments (some with marginal spines), and bifurcate tip. 8th joint: d- and e-bristles about 2/3 length of b-bristle, bare with blunt tips; f-bristle slightly shorter than c-bristle, with 7 marginal filaments (some with marginal spines); g-bristle as long as c-bristle, with 7 or 8 marginal filaments (some with marginal spines).

*Second Antenna* (Figure 15*e–g*): Bristle of 2nd exopodial joint with 8 or 9 marginal spines plus stout subterminal spine; limb otherwise similar to that of adult female.

*Mandible* (Figure 15*h*): Dorsal margin of 2nd endopodial joint with about 14 bristles; limb otherwise similar to that of female.

*Maxilla:* Similar to that of adult female.

*Fifth Limb:* Anterior side of 1st exopodial joint with additional small spinous outer bristle in addition to 2 distal bristles on female.

*Sixth Limb:* 3 bristles in place of epipodial appendage; endite III with 3 terminal bristles (1 short between 2 long); end joint with 12 or 13 bristles (posterior 2 hirsute, others with long proximal and short distal spines); limb otherwise similar to that of adult female.

*Seventh Limb* (Figure 15*i*): Each limb with 4–7 proximal bristles (2–4 on each side), each with 3–5 bells, and 11 terminal bristles (5 or 6 on each side), each with 2–5 bells; terminus with 4 finger-like teeth with digitate tip and fine marginal hairs opposite finger-like process with or without digitate tip and fine marginal hairs.

*Furca, Bellonci Organ, Eyes* (Figure 15*k*), *Anterior and Posterior of Body, Y-Sclerite:* Similar to those of adult female.

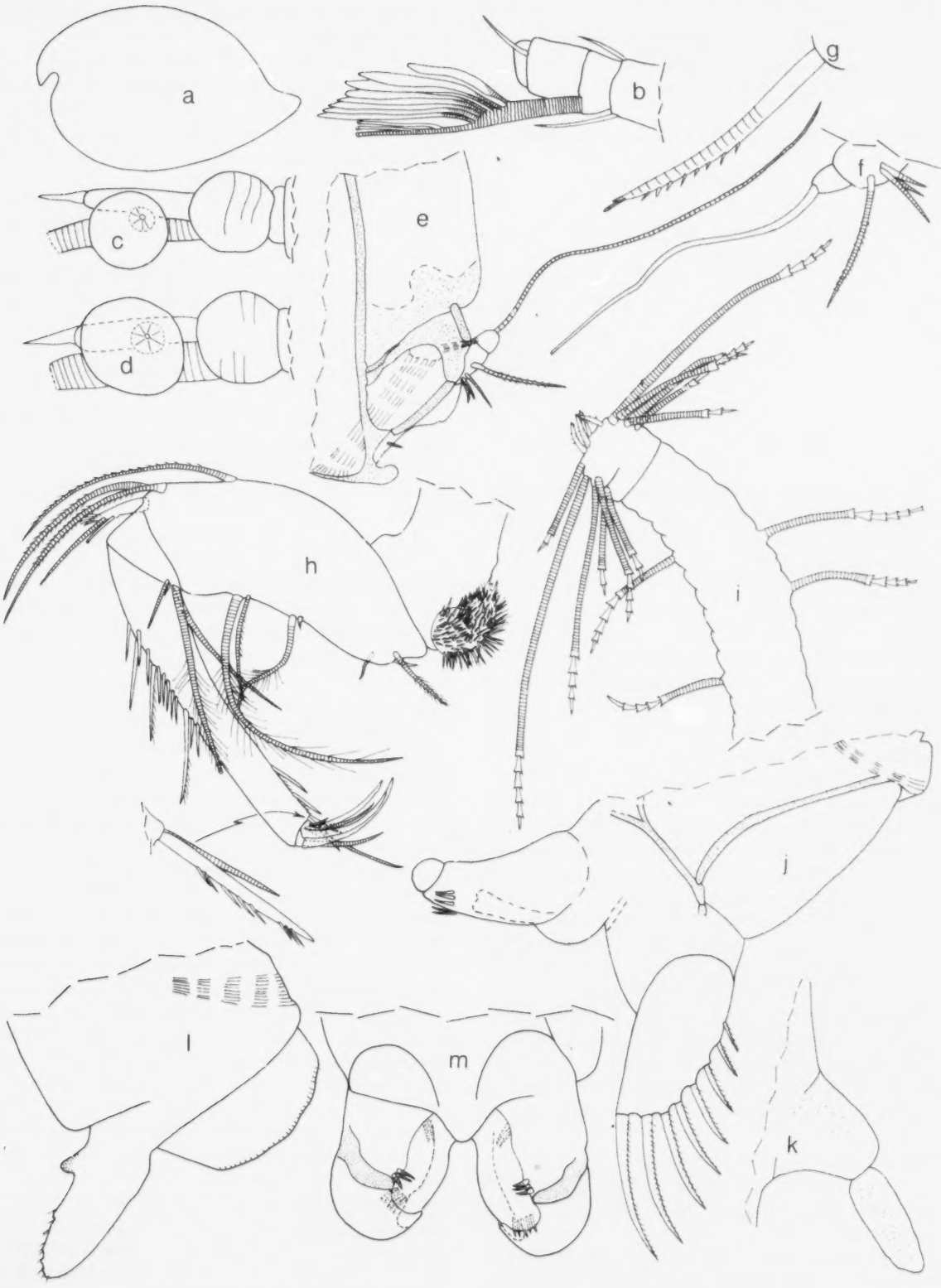
*Upper Lip* (Figure 15*l*): Similar to that of adult female, but posterior part of proximal process projecting less on some specimens.

*Genitalia* (Figure 15*j,m*): Consisting of 2 or 3 lobes (each bearing small bristles) on each side of body anterior to furca.

PARASITES.—BIOGAS III, DS-41, adult female with cypronisciid isopod and large cluster of isopod larvae; BIOGAS VI, CP-23a, juvenile with cycloniscid isopods; BIOGAS IV, DS-60, adult female with cycloniscid isopod (2 males, 1 female with abundant eggs).

VARIABILITY.—Upper lip: On most specimens whose upper lips were examined, each lip had a small but well-defined proximal, posteriorly oriented, lobe-like process on the tusks. The lobe, however, was absent on many specimens, and specimens without lobes may be more common in certain localities; e.g., 5 specimens (2 females, 1 male, 1 A-1 instar, 1 A-1 female) from CP-23a were without lobes, whereas 1 male from that sample had lobes. The presence or absence of lobes suggests that 2 species might be included in *M. quintuplex*. At present, I find it expedient to consider the lobate and non-lobate specimens to be 2 forms, rather than 2 species. The upper lip of the holotype has well-defined lobes on the tusks of the upper lip, whereas the upper lip of the illustrated male (Figure 12) is without lobes. Second antenna: The 2nd endopodial joint of this limb on most specimens is at least twice the width of the base of the terminal bristle, but on some specimens the joint is only slightly larger than the base of the bristle; the width of the joint is not related to presence or absence on lobes on the upper lip. Mandible: The basale of the mandibles bears 2 c-bristles. On almost all specimens the small c-bristle is proximal to the long c-bristle, but the opposite relationship was observed on a few specimens. Seventh limb: The finger-like process opposite the comb had a simple tip (blunt or pointed) on some specimens and a digitate tip on others. The digitate tip resembles that of the finger-like processes forming the comb, but this could not be determined with certainty at the magnification at which the 7th limbs were examined (× 100 objective).

COMPARISONS.—The carapace of the new species *M. quintuplex* resembles those of *M. ampla* Kornicker, 1970, from the Peru-Chile Trench, and *M. optilus* (Kornicker, 1968) from the Gulf of Mexico. *M. quintuplex* differs from both species in being much smaller and in lacking lateral eyes. The tusks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of the upper lip on most specimens, but not all, of *M. quintuplex* differ from those of known species of *Metavargula* in having a proximal backward oriented lobe.

### *Metavargula bilix*, new species

FIGURES 16–18

*Metavargula* species A.—Kornicker, 1985:410–412 [part, includes 2 specimens from sample DS-14, and 4 specimens from sample DS-36].

ETYMOLOGY.—From the Latin *bilix* (with a double thread).

HOLOTYPE.—Ovigerous female on slide and in alcohol, MNHN Os 266, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS III, R.V. *Jean Charcot*, west of Bay of Biscay, 47°32′42″N, 8°36′30″W; 2147 m, sta 1, sample DS-36, 24 Aug 1973.

PARATYPES.—BIOGAS I, R.V. *La Perle*, sta Hors-Zone: sample DS-14, 1 adult male (USNM 193279) + 1 instar I (USNM 158590). BIOGAS III, R.V. *Jean Charcot*, sta 1: sample DS-36, 1 adult female (USNM 193278) + 1 adult female + 1 juvenile (MNHN Os 265).

DISTRIBUTION.—West of Bay of Biscay, 1560–2147 m.

DESCRIPTION OF ADULT FEMALE (Figures 16, 17).—Carapace elongate with projecting caudal process below valve midheight (Figure 16*a*).

*Infold* (Figure 16*b,c,h*): Rostral infold with 2 bristles at inner end of incisur, 1 fairly long bristle near center of rostrum, and 9–13 shorter bristles forming row paralleling outer edge of rostrum (Figure 16*b,h*); anteroventral and ventral infold with 1 small bristle near inner margin just below incisur, followed by space and then at least 37 short bristles along narrow list; list extending from below incisur to caudal process; list of caudal process broad, with about 14 small bristles at base of 25–30 small processes along posterior edge (mostly individual bristles at base of a single process) (Figure 16*c*); 4 or 5 minute bristles on infold of caudal process posterior to list.

*Selvage:* Lamellar prolongation of the selvage broad and narrowly striate along lower margin of incisur, narrow along anterior margin of rostrum and ventral margin of valve, and absent along upper margin of incisur and posterior end of caudal process.

*Size:* Holotype (shell distorted), approximate length 3.67 mm; USNM 193278 (shell distorted), approximate length 3.55 mm; BIOGAS III, DS-36, length 3.41 mm, height 2.06 mm.

*First Antenna* (Figure 16*i*): 1st joint bare. 2nd joint with spines forming rows on medial surface and along dorsal margin. 3rd joint with 2 bristles (1 ventral, 1 dorsal). 4th joint with 2 terminal bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint unusually stout, with 10 long proximal filaments becoming broad and flat distally (broad flat part on distal 8 or 9 filaments about twice width of proximal round part), 2 long slender distal filaments, and bifurcate tip. 6th joint with slender medial bristle about 1/3 longer than joint. 7th joint: a-bristle shorter than bristle of 6th joint, with few minute marginal spines; b-bristle about 3 times length of a-bristle, with 4 short marginal filaments (some with marginal spines) and minute spine at tip; c-bristle about 1/3 longer than sensory bristle of 5th joint, with 9 marginal filaments (some with spines) and bifurcate tip. 8th joint: d- and e-bristles about 1/4 longer than b-bristle, bare with blount tips; f-bristle only slightly shorter than c-bristle, with 7 or 8 long filaments (all but last with few stout marginal spines), and bifurcate tip; g-bristle longer than c-bristle, with about 10 marginal filaments (all but last with few stout marginal spines), and bifurcate tip.

*Second Antenna* (Figure 16*d,j*): Protopodite with short medial bristle. Endopodite 2 jointed: 1st joint with 5 bristles (3 short, followed by 1 long, followed by 1 medium); 2nd joint small with long terminal filament. Exopodite: 1st joint with few small spines along concave dorsal margin; joints 3–8 with small basal spines increasing in length distally; basal spine of 8th joint about 2/3 length of 8th joint; lateral spine of 9th joint about same length as joint; joints 2–8 with faint spines forming row along distal edge; bristle of 2nd joint almost reaching 9th joint, with 12–16 ventral spines (spines small and lying quite flat against bristle with exception of stout subterminal spine), and 3 or 4 small, proximal, dorsal spines; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 4 bristles (3 long, 1 short), all with natatory hairs, no spines.

*Mandible* (Figure 16*k,l*): Coxale endite spinous, with 2 stout spines and medial peg at tip, and with small ringed bristle near base. Basale: ventral margin with 2 short a-bristles (longer of these spinous and about 7 times length of shorter bare bristle), 1 short b-bristle, 2 d-bristles (1 long with wreaths of long hairs, 1 short, bare; short bristle close to and proximal to long bristle), and 2 d-bristles (short slender bristle followed by long spinous bristle); dorsal margin with 3 bristles (1 distal to middle, 2 terminal). Exopodite reaching just past distal end of 1st endopodial joint, hirsute distally, with 2 bristles on inner margin (distal of these reaching just past midlength of other). 1st endopodial joint with 4 ventral bristles (1 long, 1 medium, 1 short, 1 minute). 2nd endopodial joint: dorsal margin spinous, and with 16 or 17 bristles (4 of these much longer than others); ventral margin spinous, and with bristles forming 3 distal groups of 1, 1, and 2 bristles (medial of these stouter than others and with spines along dorsal margin). End joint with 4 claws of unequal length and 3 ringed bristles (inner of these about same length as claws, slightly broader in its proximal 1/4,

FIGURE 15.—*Metavargula quintuplex*, new species, adult male, paratype, USNM 158592A: *a*, complete specimen from left side, length 2.38 mm; *b*, tip of right 1st antenna (bristles of joints 7 and 8 not shown), medial view; *c,d*, proximal suckers at base of b- and c-bristles of right 1st antenna, medial view; *e*, distal part of protopodite and endopodite of right 2nd antenna, medial view; *f*, endopodite of left 2nd antenna, medial view; *g*, bristle of 2nd joint of exopodite of left 2nd antenna, medial view; *h*, right mandible, medial view; *i*, 7th limb; *j*, posterior of body showing left copulatory organ, left lamella of furca, Y-sclerite and girdle (stippled); *k*, medial eye and Bellonci organ; *l*, upper lip; *m*, copulatory organs.

and with proximal spines).

*Maxilla* (Figure 17*a–d*): Precoxale and coxale with fringe of dorsal hairs; coxale with stout plumose dorsal bristle. Endite bristles obscure on mounted holotype. Basale with 1 long bristle at inner corner near exopodite. Exopodite hirsute, with 1 hirsute proximal bristle distal to midlength and 2 terminal (bristle closest to proximal bristle hirsute, other bare). 1st endopodial joint with 2 alpha-bristles (outer of the bristles long, hirsute; other shorter, slenderer, with few marginal spines), and 3 beta-bristles (outer and middle bristle pectinate, inner shorter bristle with few marginal spines); cutting tooth comprising 2 or 3 stout teeth with rounded tips. End joint: 4 a-bristles (2 smaller bristles bare, others with spines or pectinate); 3 pectinate b-bristles, 3 pectinate c-bristles, and 3 stout pectinate d-bristles.

*Fifth Limb* (Figure 17*e,f*): Protopodite with short undulate anterior tooth-like process; 3 endites with spinous bristles. Exopodite: anterior side of 1st joint with hirsute bristle with base inward from tooth-like process (this bristle could be interpreted as being on protopodite) and 3 bristles forming row (inner of these small with long proximal hairs, others long, stout, with wreaths of long spines proximally and small teeth distally); main tooth comprising smooth triangular tooth followed by 6 pectinate teeth; 1 short bristle (with long proximal spines) proximal to smooth tooth. 2nd joint with 4 a-bristles, 8 b-bristles, 1 c-bristle and 1 d-bristle. 3rd joint with 3 bristles on inner lobe and 2 on outer lobe. 4th and 5th joints fused but separated by spinous lobe, 4th joint with 3 bristles, 5th joint with 2.

*Sixth Limb* (Figure 17*g*): 2 bare bristles in place of epipodial appendage. Endite I with 2 or 3 small hirsute medial bristles and 1 long spinous terminal bristle; endite II with 2 or 3 small hirsute medial bristles and 2 long spinous terminal bristles; endite III with 3 bristles (middle bristle shorter than others), all with long marginal spines; endite IV with 3 bristles (1 or 2 long; middle bristle short), all with long marginal spines. End joint with 15 or 16 bristles (posterior 2 hirsute, others spinous).

*Seventh Limb* (Figure 17*h*): Four proximal bristles (2 on each side) and 9 terminal bristles (5 on comb side, 4 on opposite side). Terminus with comb of 4 spinous, finger-like teeth (with small tubular process at tip) opposite single slender finger-like process with few short thin hairs.

*Furca* (Figure 16*e*): Each lamella with 9 claws decreasing in size proximally along lamella; all claws separated from lamella by suture; right lamella slightly anterior to left; all claws with teeth along concave margin; medial row of teeth on claw 1 similar in size to lateral row.

*Bellonci Organ* (Figure 16*m*): Short with rounded tip.

*Eyes:* Lateral eyes minute, amber in color, with several (5–9) separated ommatidia (Figure 16*a,e,g,n*). Medial eye with light amber pigment (Figure 16*m*).

*Upper Lip* (Figure 16*f*): Anterior part with numerous small glandular openings; paired tusks weakly divided into short proximal and longer distal parts; 3 glandular openings at tip fairly large, similar faint glandular openings on lateral side of tusks; no hairs observed on tusks.

*Genitalia:* Oval ring with attached spermatophore.

*Anterior of Body:* Small irregularly rounded process at midheight between medial eye and upper lip.

*Posterior of Body:* Bare without process or spines.

*Eggs* (Figure 16*e*): Holotype with 23 eggs in marsupium; USNM 193278 with 41 large unextruded eggs, 20 or 21 on each side; BIOGAS III, DS-36 with 36 large unextruded eggs, 18 on each side.

DESCRIPTION OF ADULT MALE (Figure 18).—Carapace similar in shape to that of adult female but smaller.

*Size:* USNM 193279, length 3.18 mm, height 1.88 mm.

*First Antenna* (Figure 18*b*): 1st joint bare. 2nd joint with faint spines forming rows in vicinity of dorsal margin. 3rd joint with 2 bristles (1 ventral, 1 dorsal). 4th joint with 2 bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with very stout proximal part, 10 broad flattened filaments (proximal of these narrower than others), followed by 2 slender filaments (with minute spines at tips), and bifurcate tip (Figure 18*b*). 6th joint with slender bare medial bristle. 7th joint: a-bristle bare, slightly longer than bristle of 6th joint; b-bristle reaching just past tip of sensory bristle of 5th joint, with stout proximal filament (with large marginal sucker and small protuberance near pointed tip), followed by 2 slender filaments (each with 2 small suckers forming row); distal part of b-bristle past base of distal sucker-bearing filament unusual in being filament-like and more slender and transparent than the filaments bearing suckers; tip of b-bristle not reaching tip of distal sucker-bearing filament; c-bristle reaching just past tip of sensory bristle of 5th joint, with stout proximal filament (with large marginal sucker and small protuberance near pointed tip), followed by 1 long filament bearing 2 small suckers, 1 long bare filament, 1 long filament bearing 2 small suckers, 3 slender bare filaments, and bifurcate tip. 8th joint: d- and e-bristles about $^2/_3$ length of sensory bristle of 5th joint, bare with blunt tips; f-and g-bristles very long, about 3 times length of sensory bristle of 5th joint; f-bristle with 9 marginal filaments (with 1–3

FIGURE 16.—*Metavargula bilix*, new species, adult female, paratype MNHN Os 265: *a*, complete specimen from left side showing location of right lateral eye, length 3.41 mm. Adult female, paratype, USNM 193278, length 3.55 mm: *b*, tip of rostrum from inside showing bristles of infold; *c*, caudal process of left valve showing processes on list; *d*, bristle of 2nd joint of exopodite of 2nd antenna, lateral view; *e*, posterior of body showing 21 eggs within right side of body, right lateral eye (stippled), central adductor muscle ends, and furca (furcal claws not shown); *f*, anterior of body showing medial eye and Bellonci organ, anterior process, and upper lip; *g*, right lateral eye (viewed with ×100 objective). Ovigerous female, holotype, length 3.67 mm: *h*, anterior of right valve from inside showing bristles of infold; *i*, left 1st antenna (d- and e-bristles not shown), medial view; *j*, distal part of protopodite and endopodite of right 2nd antenna, medial view; *k*, right mandible (coxale not shown), medial view; *l*, tip of left mandible, medial view; *m*, medial eye and Bellonci organ; *n*, lateral eye (viewed with ×10 objective); *o*, upper lip, anterior towards left.

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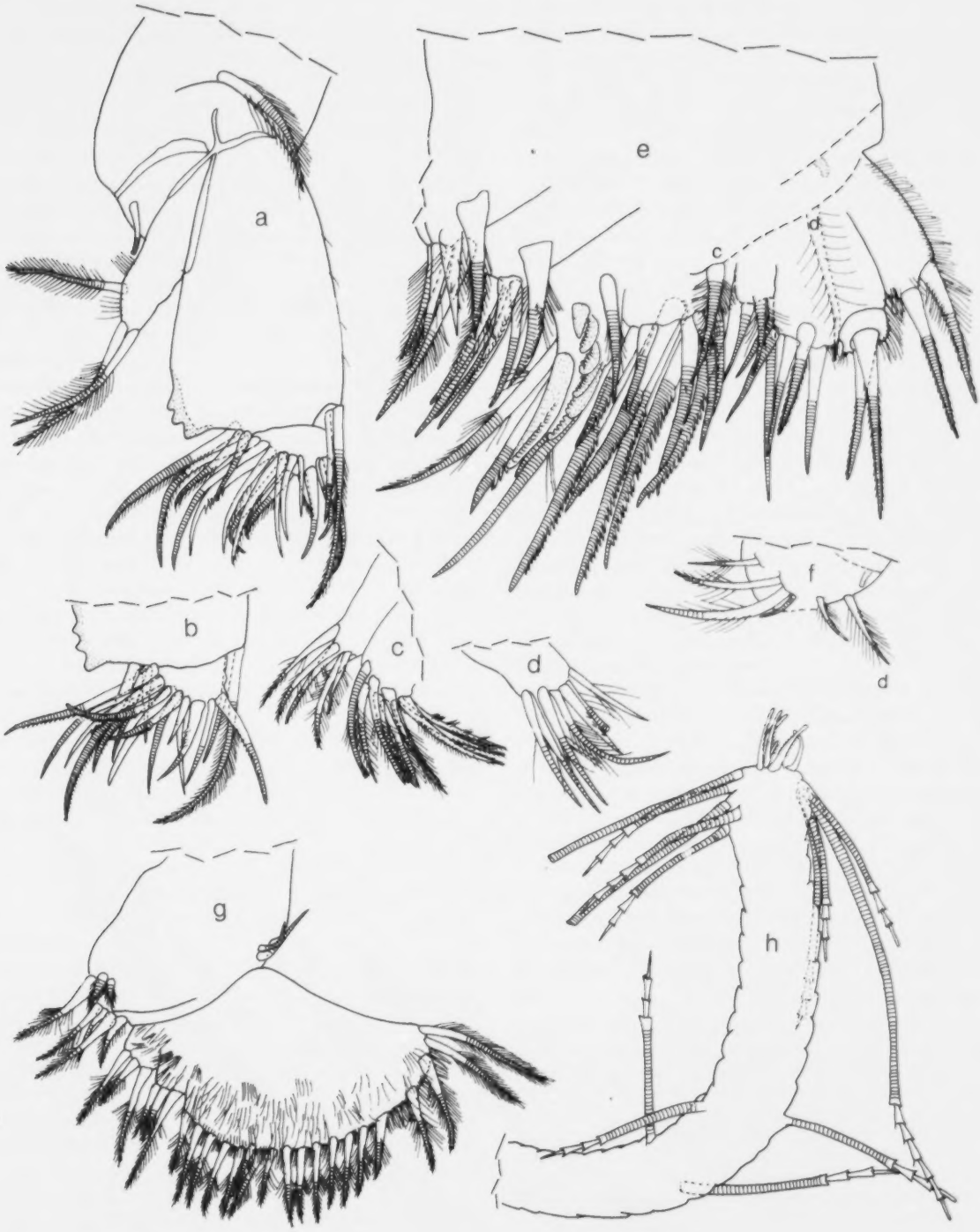



FIGURE 17.—*Metavargula bilix*, new species, ovigerous female, holotype MNHN Os 266: *a*, right maxilla, lateral view (endites not shown); *b*, tip of left maxilla, medial view; *c,d*, endites of maxilla; *e*, right 5th limb, posterior view; *f*, part of left 5th limb, anterior view; *g*, 6th limb; *h*, 7th limb.

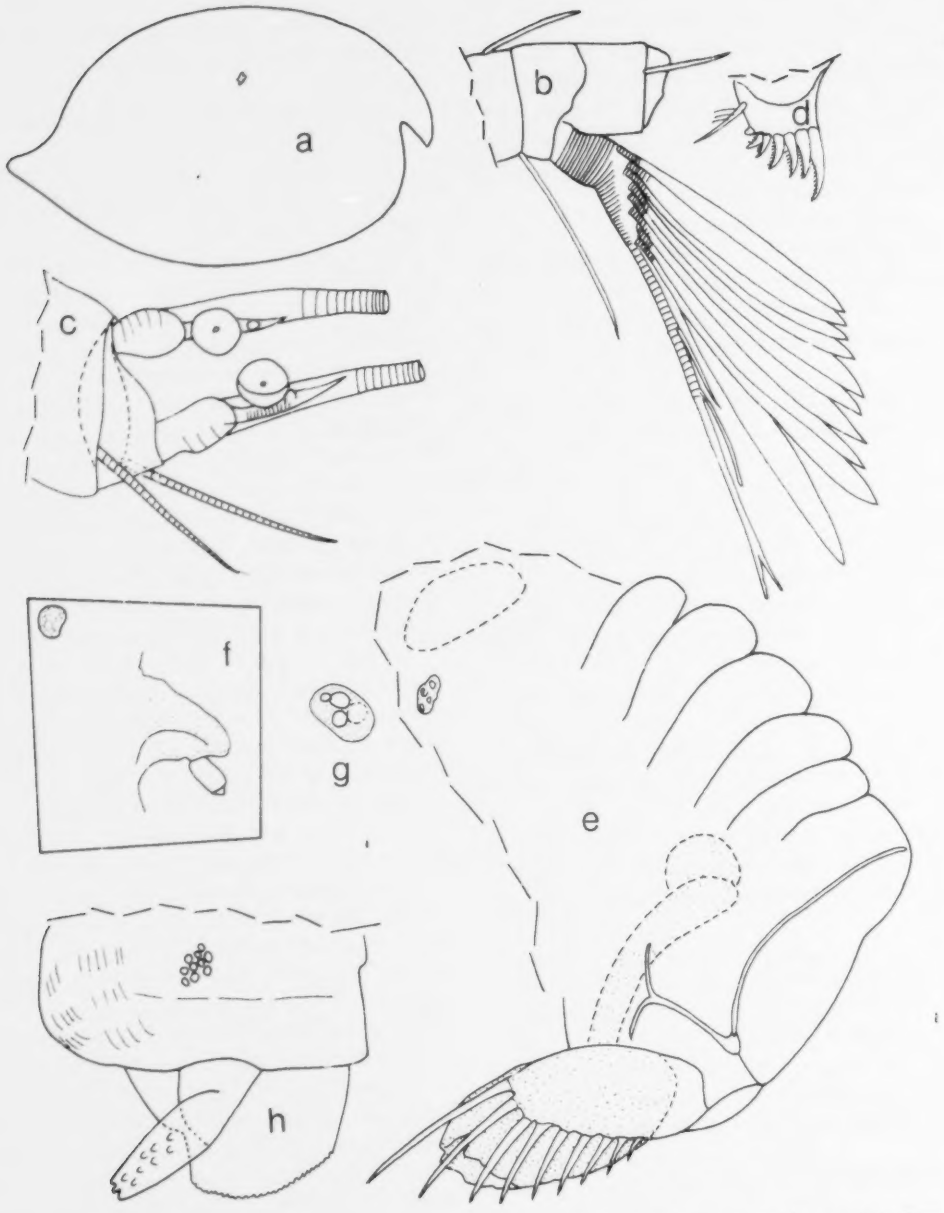



FIGURE 18.—*Metavargula bilix*, new species, adult male, paratype, USNM 199279: *a*, complete specimen from right side showing location of right lateral eye, length 3.18 mm; *b*, distal part of left 1st antenna (bristles of joints 7 and 8 not shown), medial view; *c*, tip of left 2nd antenna showing bristle of 6th joint, a-bristle of 7th joint, and proximal suckers of b-and c-bristles of 7th joint; *d*, teeth and bristle of 1st exopodial joint of 5th limb, posterior view; *e*, posterior of body showing outline of heart (dashed), left lateral eye, left lamella of furca, left copulatory organ, Y-sclerite and girdle, and 5 lobes forming posterior margin posterior to girdle; *f*, right lateral eye, medial eye and Bellonci organ (viewed with ×10 objective); *g*, left lateral eye (viewed with ×20 objective); *h*, upper lip, note proximal glandular field.

proximal spines) and bifurcate tip; g-bristle with 10 marginal filaments (with 1–3 proximal spines) and bifurcate tip.

*Second Antenna:* Protopodite and endopodite similar to those of adult female, except protopodite slightly larger. Exopodite: bristle of 2nd joint just reaching 8th joint, with 3 or 4 proximal dorsal spines and 13–17 ventral spines; spines (except last ventral spine) subdued as on female; exopodite otherwise similar to that of adult female.

*Mandible:* Similar to that of adult female.

*Maxilla:* Endite I with about 11 spinous bristles; endites II and III each with 5 spinous bristles. Cutting tooth of 1st endopodial joint with 3 prongs (proximal prong with angular tip, others rounded); limb otherwise similar to that of adult female.

*Fifth Limb* (Figure 18*d*): 4th exopodial joint with 5 bristles; limb otherwise similar to that of adult female.

*Sixth Limb:* End joint with 17 bristles; limb otherwise similar to that of adult female.

*Seventh Limb:* Each limb with 4 or 5 proximal bristles (2 or 3 on each side, each with 3 or 4 bells, and 9 terminal bristles (4 or 5 on each side), each with 3–6 bells; terminus with 2 or 3 spinous finger-like teeth opposite similar finger-like process without spines, all processes with tips appearing rounded, digitate, or with small tubular process.

*Furca, Bellonci Organ* (Figure 18*e*): Similar to those of adult female.

*Eyes:* Medial eye similar to that of adult female (Figure 18*f*). Lateral eye similar to that of adult female, except only 4 ommatidia observed (Figure 18*e–g*).

*Upper lip* (Figure 18*h*): Similar to that of adult female.

*Genitalia* (Figure 18*e*): Well developed of similar type to that of *P. quintuplex* illustrated herein; when extended reaching tip of furcal claws.

*Posterior of Body* (Figure 18*e*): Posterodorsal end of body with 5 lobes on each side. (The lobes are not separatable from underlying torso as with members of the Cylindroleberididae, and are poorly developed in the female.)

COMPARISONS.—*Metavargula bilix* differs from *M. quintuplex* in having small lateral eyes, and in having 5 instead of 4 bristles on the 1st endopodial joint of the 2nd antenna.

### *Metavargula hex*, new species

FIGURES 19–21

*Metavargula* species A.—Kornicker 1985:410–412 [part, including only specimens from samples DS-48 and DS-77].

ETYMOLOGY.—From the Greek *hex* (six).

HOLOTYPE.—Adult female on slide and in alcohol, MNHN Os 267, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS VI, R.V. *Jean Charcot*, west of Bay of Biscay, 47°31′48″N, 9°34′36″W, 4240 m, sta 3, sample DS-77, 24 Oct 1974.

PARATYPES.—BIOGAS III, R.V. *Jean Charcot*, sta 1: sample DS-48, 1 adult male (MNHN Os 268). BIOGAS VI, R.V. *Jean Charcot*, sta 3: sample DS-77, 2 juveniles (USNM 193345).

DISTRIBUTION.—In and west of Bay of Biscay, 4203–4240 m.

DESCRIPTION OF ADULT FEMALE (Figures 19, 20).—Carapace elongate with projecting caudal process below midheight (Figure 19*a*).

*Infold* (Figure 19*b,c*): Rostral infold with 2 bristles (1 long, 1 short) at inner end of incisur; and about 17 bristles (mostly forming row paralleling outer edge of rostrum) and 4 pores possibly representing bristle sockets; 1 small bristle near the 2 bristles at inner end of incisur. Anteroventral and ventral infold with 1 small bristle near inner end of incisur, followed by space and then about 60 short bristles along narrow list; list extending from below incisur to caudal process; list broad anterior to caudal process, with about 17–20 minute processes (with pore at tip) along posterior edge, 3 or 4 minute bristles just anterior to processes, about 11 bristles near anterior edge of list, and about 6 minute bristles near posterior edge of list dorsal to the processes; caudal process posterior to list with numerous minute pores (not shown on illustrated valve).

*Selvage:* Lamellar prolongation of selvage broad and indistinctly striate along lower margin of incisur (Figure 19*b*), narrow along anteroventral and ventral margin of valves and dorsal to caudal process; selvage absent at posterior end of caudal process and along upper edge of incisur; prolongation divided at innermost end of incisur; minute length of prolongation at inner end of incisur with ventral end at pair of bristles at inner end of incisur (Figure 19*b*).

*Size:* Length 4.02 mm, height 2.29 mm.

*First Antenna* (Figure 19*d*): 1st joint bare. 2nd joint with hairs on medial surface and ventral margin. 3rd joint with medial hairs and 2 spinous bristles (1 ventral, 1 dorsal). 4th joint with 2 spinous bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 8 long proximal filaments (filaments with short narrow proximal part; distal part about 1½ width of proximal part) followed by 2 slender filaments (with spine at tip) and bifurcate tip. Medial bristle of 6th joint about same length as joint (tip of bristle broken on illustrated limb). 7th joint: a-bristle about same length but slightly broader than bristle of 6th joint; b-bristle about twice length of a-bristle, with 4 marginal filaments, some filaments with marginal spines; c-bristle longer than sensory bristle of 5th joint, with 8 marginal filaments and bifurcate tip (tip of bristle broken on illustrated limb, and not all filaments shown; some filaments with marginal spines). 8th joint: d- and e-bristles about ⅓ longer than b-bristle, bare with blunt tips (d- and e-bristles not shown on illustrated limb); f-bristle about same length as sensory bristle of 5th joint, with 7 marginal filaments and bifurcate tip (tip of bristle broken on illustrated limb), some filaments with marginal spines; g-bristle about same length as

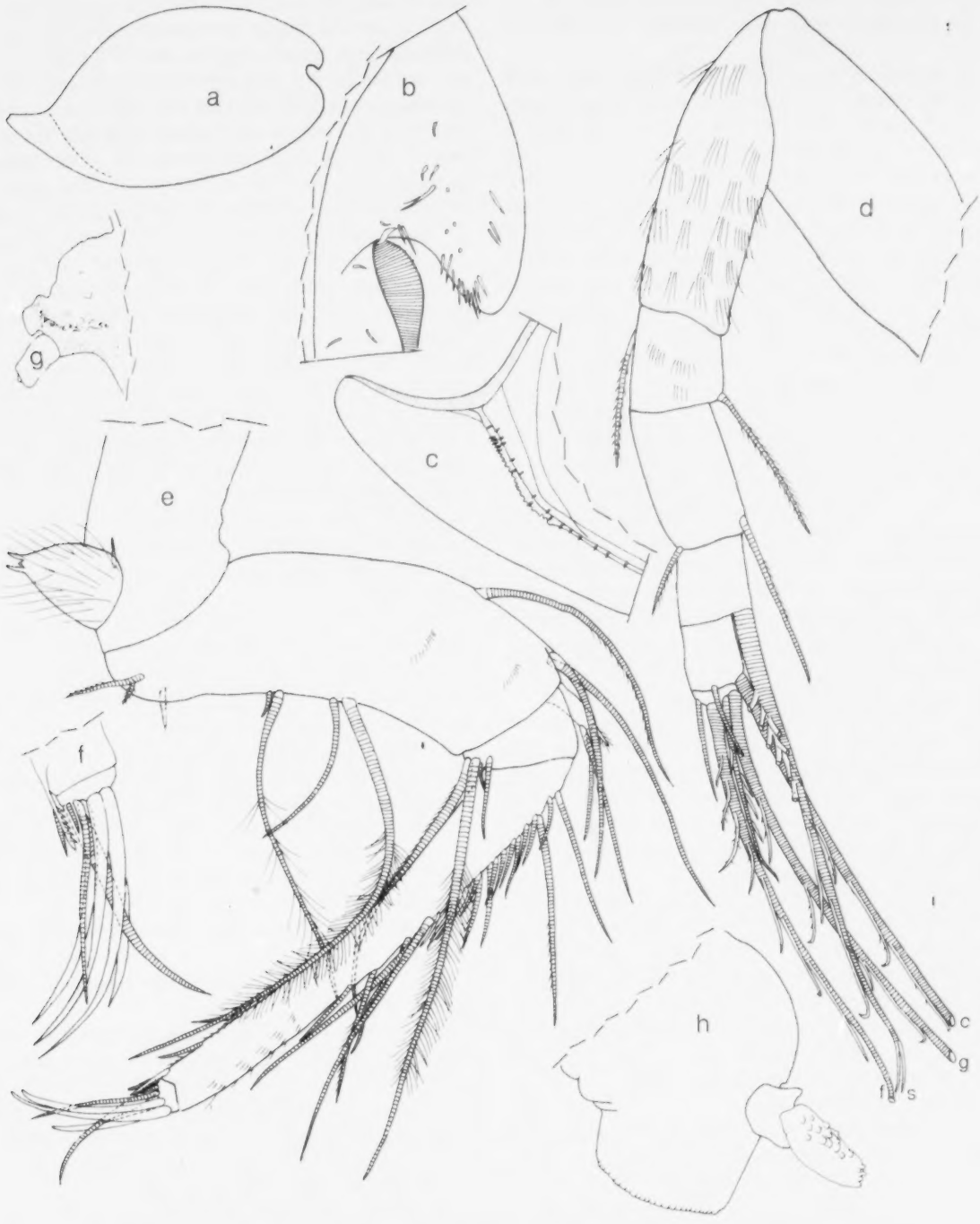



FIGURE 19.—*Metavargula hex*, new species, ovigerous female, holotype, MNHN Os 267: *a*, complete specimen from right side, length 4.02 mm; *b*, anterior of left valve from inside showing bristles of infold and broad lamellar prolongation of selvage; *c*, caudal process of left valve from inside; *d*, right 1st antenna (d- and e-bristles not shown), medial view; *e*, left mandible, medial view; *f*, tip of left mandible, medial view; *g*, medial eye and Bellonci organ; *h*, upper lip, anterior to left.

c-bristle, with about 8 marginal filaments and bifurcate tip (tip broken on illustrated limb), some filaments with marginal spines.

*Second Antenna* (Figure 20*a*): Protopodite with short medial bristle (absent on left limb of illustrated specimen). Endopodite 2-jointed: 1st joint with 4 bristles (2 short, 1 medium, 1 long), longest with marginal spines; 2nd joint short, with long terminal bristle. Exopodite: 1st joint with few small spines along dorsal concave margin; joints 3–8 with basal spines increasing in length distally; basal spine of 8th joint almost same length as 9th joint; 9th joint with lateral spine about same length as joint; bristle of 2nd joint reaching past 9th joint, with about 24 ventral spines, no hairs, ultimate spine longer and stouter than others; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 4 bristles (3 long, 1 short), all with natatory hairs, no spines.

*Mandible* (Figure 19*e,f*): Coxale endite spinous, with 2 stout spinous processes and medial peg at tip, and small bristle near base. Basale: ventral margin with 2 small a-bristles, one small b-bristle, 2 c-bristles (1 long with wreaths of long hairs, 1 short, bare just proximal to long bristle), and 2 d-bristles (short slender bristle followed by long spinous bristle); dorsal margin with 3 bristles (1 distal to midlength, 2 terminal). Exopodite reaching just past distal end of 1st endopodial joint, hirsute distally, with 2 bristles on inner margin (distal bristle reaching just past midlength of proximal bristle). 1st endopodial joint with 4 ventral bristles (2 long, 1 short, 1 minute). 2nd endopodial joint: dorsal margin with about 20 bristles (5 of these much longer than others); ventral margin with bristles forming 3 distal groups of 1, 1, and 2 (medial of distal pair stouter than others and with spines on dorsal margin). End joint with 4 claws (lateral dorsal claw shorter than others) and 3 ringed bristles (lateral bristle about same length as longer claws and broader in proximal 1/3; spines present along ventral margin of broad proximal part).

*Maxilla* (Figure 20*b*): Protopodite with plumose dorsal bristle. Endite I with 11 spinous bristles; endite II with 5 spinous bristles; endite III with 8 spinous bristles and 1 small proximal bare bristle. Basale with 2 bare bristles (1 long, 1 short and distal to other) at inner distal edge. Exopodite with 1 hirsute proximal bristle just distal to midlength (not shown on illustrated limb) and 2 terminal bristles of subequal length (about same length as proximal bristle; bristle closest to proximal bristle hirsute, other bare). 1st endopodial joint with 2 alpha-bristles (outer long, hirsute, inner shorter, bare), and 3 beta-bristles (outer and middle bristles pectinate, inner small bristle bare); cutting blade comprising 4 or 5 pointed teeth. End joint with 4 a-bristles, 3 b-bristles, 3 c-bristles, and 3 d-bristles.

*Fifth Limb* (Figure 20*c–f*): Protopodite with short, undulate, anterior, tooth-like process. Endites I-III obscure on specimen studied. Exopodite: anterior side of 1st joint with 2 spinous bristles near tooth of protopodite and 3 spinous bristles forming row closer to main tooth (Figure 20*d*); main tooth comprising smooth triangular tooth followed by 5 pectinate teeth (Figure 20*e*); 1 spinous bristle proximal to triangular tooth. 2nd exopodial joint with 5 a-bristles, about 6 b-bristles, 1 c-bristle and 1 d-bristle. 3rd joint with 3 bristles on inner lobe and 3 on hirsute outer lobe. 4th joint separated from 5th by suture, with hairs near margin and 5 bristles. 5th joint hirsute, with 2 bristles, and small spinous process on distal margin near boundary separating 4th and 5th joints. (The presence of 3 bristles rather than the 2 usually found on the outer lobe of the 3rd exopodial joint of both limbs of the specimen may be an aberration; only 2 were present on the male described herein.)

*Sixth Limb* (Figure 20*g*): 3 short bare bristles and 1 longer plumose bristle in place of epipodial appendage. Endite I with 3 small, hirsute, medial bristles and 1 long, spinous, terminal bristle; endite II with 4 small, hirsute, medial bristles and 2 long, stout, terminal bristles; endite III with 2 medium and 2 long, spinous, terminal bristles; endite IV with 1 or 2 medium and 2 long, spinous, terminal bristles. End joint with 18 bristles (last 3 hirsute to tip, others with long proximal marginal spines and short distal spines near tip).

*Seventh Limb* (Figure 20*h*): Illustrated limb with 11 proximal filaments with 2–5 bells and 11 terminal bristles with 2–5 bells; comb with 5 finger-like teeth (all with thin marginal hairs) opposite finger-like process with pointed tip and few faint marginal hairs. Opposite limb with 6 proximal bristles on peg side and only 1 (aberrant?) on comb side, and with 12 terminal bristles, 6 on each side; bristles with 2–5 bells; comb with 4 teeth (similar to those of illustrated limb) opposite finger-like process with rounded tip.

*Furca:* Each lamella with 8 claws decreasing in size proximally along lamella; right lamella slightly anterior to left; claws with teeth along posterior margin and short hairs along anterior margin; claws 1–5 curved, claws 6–8 linear; teeth forming medial row on claw 1 about same size, or only slightly larger, than teeth forming lateral row; spines on lamellae following claws.

*Bellonci Organ* (Figure 19*g*): Short, cylindrical, with small knob at tip.

*Eyes:* Lateral eyes absent. Medial eye small with brown pigment (Figure 19*g*).

*Upper Lip* (Figure 19*h*): Anterior part with numerous small glandular openings; paired part consisting only of stout tusks divided into proximal part with backward oriented process and long distal part with lateral and terminal glandular openings; proximal and distal parts separated by suture.

*Genitalia:* Oval ring on each side of body.

*Posterior of Body:* Without process.

Y-*Sclerite:* Typical for subfamily.

DESCRIPTION OF ADULT MALE (Figure 21).—Carapace similar in shape to that of female but smaller (Figure 21*a*).

*Size:* Length 2.98 mm, height 1.79 mm.

*First Antenna* (Figure 21*b*): Joints 1–6 similar to those of female except proximal part of stem of sensory bristle of 5th joint much stouter (width almost half that of distal margin of

FIGURE 20.—*Metavargula hex*, new species, ovigerous female, holotype, MNHN Os 267: *a*, distal part of protopodite and endopodite of right 2nd antenna, medial view; *b*, maxilla; *c*, distal part of right 5th limb (hirsute c-bristle not shown), posterior view; *d*, distal part of right 5th limb, anterior view; *e*, teeth and bristle of 1st exopodial joint of left 5th limb, posterior view; *f*, exopodial joints of 5th limb; *g*, left 6th limb, medial view; *h*, 7th limb.

FIGURE 21.—*Metavargula hex*, new species, adult male, paratype, MNHN Os 268: *a*, complete specimen from right side, length 2.98 mm; *b*, tip of right 1st antenna showing sensory bristle of 5th joint, medial bristle of 6th joint, and a-bristle of 7th joint, medial view; *c*, endopodite of left 2nd antenna, medial view; *d*, maxilla (endites not shown); *e*, exopodial joints of right 5th limb, posterior view; *f*, distal part of left 5th limb, anterior view; *g*, right 6th limb, medial view; *h*, 7th limb; *i*, copulatory organs.

5th joint) and long proximal filaments (8) broad paddle-like. 7th joint: a-bristle about 1/3 longer than medial bristle of 6th joint; b-bristle about 3 times length of a-bristle, with stout proximal filament (with large marginal sucker and small protuberance near pointed tip), followed by 2 slender filaments (with 2 or 3 small suckers forming row) and 1 filament without suckers; c-bristle about twice length of sensory bristle of 5th joint, with stout proximal filament (with large marginal sucker), followed by 2 slender filaments (each with 2 or 3 small marginal suckers), 5 slender filaments (some with marginal spines), and bifurcate tip. 8th joint: d- and e-bristles longer than b-bristle, bare with blunt tips; f-bristle about same size or slightly smaller than c-bristle, with 8 marginal filaments with marginal spines; g-bristle as long as c-bristle, with 9 marginal filaments with marginal spines.

*Second Antenna* (Figure 21*c*): Similar to that of female.

*Mandible:* Dorsal margin of 2nd endopodial joint with about 16 bristles; limb otherwise similar to that of female.

*Maxilla* (Figure 21*d*): Similar to that of adult female, except cusps of cutting tooth of 1st endopodial joint rounded. All bristles not shown on illustrated limb.

*Fifth Limb* (Figure 21*e*): Outer lobe of 3rd exopodial joint with only 2 bristles; limb otherwise similar to that of female.

*Sixth Limb* (Figure 21*g*): 1 spinous bristle and no or 1 short bristle in place of epipodial appendage. Endite I with 2 medial bristles and 1 terminal bristle; endite II with 3 medial and 2 terminal bristles; endite III with 3 terminal bristles; endite IV with 2 or 3 terminal bristles. End joint margin with 8 or 9 spinous bristles followed by short space and then 1 spinous and 2 hirsute bristles.

*Seventh Limb* (Figure 21*h*): Each limb with 3 or 4 proximal bristles (1 or 2 on each side), each with 3–5 bells, and 13 or 14 terminal bristles (6–8 on each side), each with 2–4 bells; terminus with 5 linear teeth with digitate tips opposite single similar tooth.

*Furca, Bellonci Organ, Eyes, Upper Lip, Posterior of Body:* Similar to those of adult female.

*Genitalia* (Figure 21*i*): Well developed, each limb with several lobes bearing small bristles; distal end broadly rounded.

COMPARISONS.—The new species *M. hex* differs from *M. bilix* in not having lateral eyes, in having 8 instead of 9 claws on each lamella of the furca, and in having only 4 instead of 5 bristles on the 1st joint of the endopodite of the 2nd antenna. The carapace of *M. hex* is longer than that of *M. quintuplex* (female 4.02 mm compared to 2.74–3.22 mm; male 2.98 mm compared to 2.38–2.67 mm); also, the longest epipodial bristle on the 6th limb of *M. hex* is spinous, whereas, the bristle is bare on *M. quintuplex*.

### *Metavargula* species indeterminate

MATERIAL.—BIOGAS I, R.V. *La Perle*, sta Hors-Zone: sample DS-14, 2 juveniles (USNM 193346). BIOGAS V, R.V. *Cryos*, sta 2, sample DS-66, 3 juveniles (USNM 193262). BIOGAS VI, R.V. *Jean Charcot*, sta 3: sample DS-76, 1 instar III (USNM 193263).

REMARKS.—The specimens were too juvenile to refer to a species with certainty.

### *Rheina*, new genus

ETYMOLOGY.—From the Greek *rheos* (current).

TYPE SPECIES.—*Rheina prex* Kornicker, new species.

DISTRIBUTION.—Known only from in and west of the Bay of Biscay at abyssal depths.

COMPOSITION.—The genus is proposed for a new species described herein, *Rheina prex*.

DIAGNOSIS (based only on type species).—Carapace elongate having caudal process curving upward and with truncate tip; type species large: length of female 3.72 mm, male 3.29 mm.

*First Antenna:* Sensory bristle of 5th joint with long slender proximal and short slender distal filaments; filaments of male sensory bristle not broad.

*Second Antenna:* Endopodite of male and female similar, 3 jointed: 1st joint with 5 bristles; 2nd joint elongate, bare; 3rd joint short with long terminal bristle. Bristle of 2nd exopodial joint with numerous ventral spines.

*Furca:* Type species with 9 claws on female and 7 on male; claw 2 fused to lamella.

*Bellonci Organ:* Short, cylindrical, with rounded tip.

*Eyes:* Medial eye small, unpigmented. Lateral eyes absent.

*Upper Lip:* With unpaired anterior part and paired well-developed posterior tusks extending past ventral edge of anterior part.

COMPARISONS.—The new genus is defined mainly by having a 2nd antenna with a well-developed 3-jointed endopodite with an elongate bare 2nd joint; an upper lip with 2 long paired posterior tusks; and a sensory bristle of the 5th exopodial joint of the male 1st antenna with slender proximal filaments. *Rheina* differs from species of *Vargula* Skogsberg, 1920, and *Sheina* Harding, 1966, in not having a small bristle on the 2nd joint of the endopodite of the 2nd antenna. In Kornicker, 1983:19, "Key to genera of the Cypridina Group and Group?" *R. prex* runs down to *Sheina* because of the absence of a bristle on the 2nd endopodial joint of the 2nd antenna; however, in a restudy of the type species of *Sheina* by Kornicker (1986) it was shown that *Sheina* does have a bristle on the 2nd joint. *Rheina* differs from species of *Bathyvargula* and *Metavargula* in having an elongate 2nd joint on the endopodite of the 2nd antenna; also, known males of species *Bathyvargula* and *Metavargula* have very broad proximal filaments on the sensory bristle of the 1st antenna.

DISCUSSION.—*Vargula* could be expanded to include both *Rheina* and *Sheina*, but because the number of known species referred to *Vargula* is rapidly increasing it is expedient not to broaden the concept of *Vargula*.

### *Rheina prex*, new species

FIGURES 22–26

*Vargula?* species A.—Kornicker, 1985:410 [excluding specimen from sample DS-60 referred to *Hadacypridina biscayensis*, herein].

ETYMOLOGY.—The species name from the Latin *prex* (prayer).

HOLOTYPE.—Adult female on slide and in alcohol, MNHN Os 139, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—Biogas VI, R.V. *Jean Charcot*, west of the Bay of Biscay, 47°34′48″N, 9°33′18″W, 4228 m, sta 3, sample DS-76, 23 Oct 1974.

PARATYPES.—BIOGAS IV, R.V. *Jean Charcot*, sta 3: sample DS-55, 1 instar IV (USNM 193171). Sta 5: sample DS-53, 1 juvenile + 1 early instar. BIOGAS VI, R.V. *Jean Charcot*, sta 3: sample DS-76, 1 adult male (USNM 193170) plus 4 juveniles. Sta 4: sample CP-16a, 1 juvenile; sample DS-79, 1 juvenile. Paratypes in Paris: MNHN OS 140-143.

ADDITIONAL MATERIAL.—BIOGAS IV, R.V. *Jean Charcot*, sta 5: sample DS-53, 1 early instar.

DISTRIBUTION.—In and west of the Bay of Biscay at abyssal depths, 4125–4825 m.

DESCRIPTION OF ADULT FEMALE (Figures 22–24*a*,*b*).—Carapace elongate; caudal process with upward sweep and truncate tip (Figure 22*a*); anterior edge of rostrum straight (Figure 22*a*,*b*); shell overlapping edge along serrate anteroventral margin (Figure 22*c*).

*Infold* (Figure 22*b*–*e*): Rostral infold with about 26 bristles; inner end of incisur with 2 bristles (1 long, 1 short) near edge and 2 or 3 shorter proximal bristles; 2 or 3 bristles near edge of shell ventral to incisur (Figure 22*b*); anteroventral and ventral infold to about valve mid-length with approximately 30 short bristles along narrow list; list extending from posterior third of ventral margin of valve to dorsal end of broad list along caudal process bearing about 21 minute bristles; about 7 minute indistinct bristles on infold of caudal process posterior to list; list of caudal process forming ledge wider on right valve (Figure 22*d*,*e*); 5 small bristles present between list and valve edge on ventral infold just anterior to caudal process.

*Selvage:* Lamellar prolongation of selvage broad and striate along lower margin of incisur, narrow and without striations elsewhere, and absent along posterior end of caudal process.

*Size:* Holotype, length 3.72 mm, height 2.53 mm.

*First Antenna* (Figure 23*a*): 1st joint bare. 2nd joint spinous. 3rd joint short, with 2 spinous bristles (1 ventral, 1 dorsal). 4th joint with 2 spinous bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with 10 long proximal filaments, 2 shorter and slender distal filaments, and bifurcate tip. 6th joint with short spinous medial bristle. 7th joint: a-bristle about twice length of bristle of 6th joint, spinous; b-bristles only slightly longer than a-bristle, with 5 short proximal filaments (only 2 of these shown on illustrated limb); c-bristle about 1/3 longer than sensory bristle of 5th joint, with 9 short filaments (with few marginal spines), and bifurcate tip. 8th joint: d- and e-bristles about twice length of a-bristle, bare with blunt tips (tip of e-bristle broken on illustrated limb); f-bristle about 3/4 length of c-bristle, with 9 short marginal filaments (some with minute marginal spines), and bifurcate tip; g-bristle longer than f-bristle, with 9 short filaments (with minute marginal spines), and bifurcate tip. (Minute spines on marginal filaments not shown on illustrated limb.)

*Second Antenna* (Figure 23*b*): Protopodite with short bare bristle. Endopodite 3-jointed: 1st joint with 4 short proximal bristles (distal of these longer than others) and 1 longer distal bristle; 2nd joint elongate, bare; 3rd joint short with long terminal bristle. Exopodite: bristle of 2nd joint just reaching past 9th joint; ventral margin of bristle with 15 stout pointed spines; dorsal margin of bristle with 1 faint spine just proximal to proximal ventral spine; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 4 bristles (3 long with natatory hairs, 1 short with sparsely distributed short spines); 1st joint with minute spines forming rows near dorsal margin; 2nd joint with minute ventral spines at mid-length; joints 3–8 with minute basal spines and faint short spines forming narrow row along distal lateral margin; 9th joint with 2-pronged, lateral spine about same length as 9th joint, each prong with 2 or 3 minute spines.

*Mandible* (Figure 24*a*): Coxale: small ringed bristle near base of endite; endite spinous, with terminal paired spines stouter than others. Basale: ventral margin with 2 small a-bristles, 1 small bare b-bristle, 2 bare c-bristles (1 small, 1 long), and 2 d-bristles (1 small, 1 very long); dorsal margin with 3 bristles (1 distal to middle, 2 subterminal); medial surface with few, small, faint, proximal spines. Exopodite reaching distal margin of 1st endopodial joint, with distal hairs and 2 distal ventral bristles (proximal bristle longer than other). 1st endopodial joint with 4 ventral bristles (2 long, 2 short). 2nd endopodial joint: spinous ventral margin with 4 slender bristles forming 3 groups with 1 bristle in each of 2 proximal groups and 2 in terminal group (bristles of latter group slightly stouter than others); dorsal margin with about 21 bristles (about 7 short and 14 long, most with spines). End joint with 2 stout claws (each with few ventral spines) and 4 slender bristles (medial ventral bristle minute; slender dorsal bristle with pointed tip and weakly developed rings).

*Maxilla* (Figure 23*c*): Endite I with about 11 spinous bristles, some with spear-like tips; endite II with 5 spinous and pectinate bristles, some with spear-like tips; endite III with 1 proximal bristle and 6 spinous and pectinate terminal bristles, some with spear-like tips. Precoxale and coxale with dorsal hairs; coxale with stout hirsute dorsal bristle. Distal margin of basale with 2 bristles (ventral bristle long, medial bristle short). Exopodite well developed, hirsute, with 1 plumose, proximal, ventral bristle and 2 terminal bristles (ventral bristle plumose, dorsal bristle with few hairs). 1st endopodial joint: cutting tooth with 4 cusps; dorsal margin spinous, with 2 spinous alpha-bristles; ventral margin with 3 beta-bristles (medial

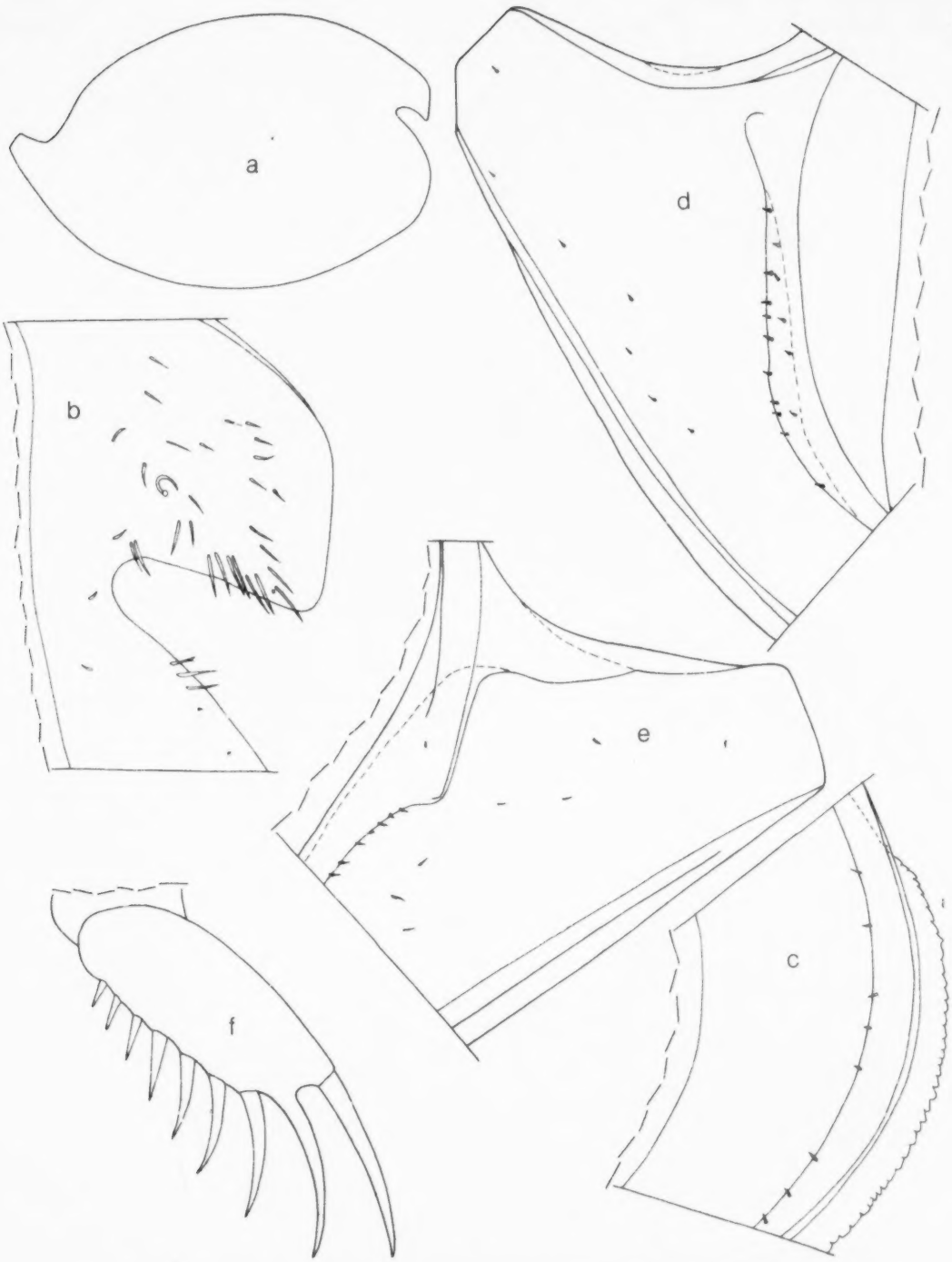



FIGURE 22.—*Rheina prex*, new species, adult female, holotype, MNHN Os 139: *a*, complete specimen from right side, length 3.72 mm; *b*, anterior of left valve from inside showing bristles of infold; *c*, anteroventral corner of left valve showing slight lateral overlap; *d*, caudal process of left valve from inside showing bristles of infold and list; *e*, caudal process or right valve from inside; *f*, right lamella of furca.

FIGURE 23.—*Rheina prex*, new species, adult female, holotype, MNHN Os 139: *a*, left 1st antenna, medial view; *b*, endopodite of 2nd antenna; *c*, maxilla (endites not shown); *d*, left 5th limb (not all endite bristles shown), posterior view; *e*, anterior bristles of 1st exopodial joint of right 5th limb; *f*, terminal comb and peg of 7th limb; *g*, medial eye and Bellonci organ; *h*, upper lip and anterior process.

FIGURE 24.—*Rheina prex*, new species, adult female, holotype, MNHN Os 139: *a*, right mandible, medial view; *b*, right 6th limb, medial view. Adult male, paratype: *c*, complete specimen from left side, length 3.29 mm; *d*, distal part of protopodite and endopodite of right 2nd antenna, medial view; *e*, right 5th limb, posterior view; *f*, distal part of left 5th limb (not all bristles shown), anterior view.

bristle stout, pectinate; lateral bristles slender, bare). 2nd endopodial joint with 3 or 4 a-bristles (inner 2 pectinate, outer 2 with few faint spines), 3 pectinate b-bristles, 3 c-bristles (2 pectinate, 1 small, bare) and 3 pectinate d-bristles.

*Fifth Limb* (Figure 23*d,e*): Endites I–III with spinous and pectinate bristles. Protopodite with short sclerotized anterior tooth. 1st exopodial joint: main tooth consisting of stout peg and 6 pectinate teeth; spinous bristle proximal to peg; 3 bristles in anterior group with long proximal hairs. 2nd exopodial joint with 4 pectinate a-bristles, 7 pectinate b-bristles, 1 short c-bristle with long proximal and short distal spines, and 1 long d-bristle with long proximal and short distal spines. 3rd exopodial joint with 3 bristles (proximal bristle with long proximal hairs) on inner lobe and 2 terminal bristles (with long proximal and short distal spines) on hirsute outer lobe. 4th and 5th joints separated by weak suture; 4th joint with 4 bristles (some with short spines); 5th joint with 2 spinous terminal bristles and small process (bearing spines) near base of inner bristle; both 4th and 5th joints hirsute.

*Sixth Limb* (Figure 24*b*): 4 or 5 small bare bristles in place of epipodite. Endite I with 4 short plumose medial bristles and 1 long spinous terminal bristle; endite II with 3 short plumose medial bristles and 2 longer spinous terminal bristles; endite III with 1 medial bristle (with long proximal hairs) and 3 terminal spinous bristles; endite IV with 1 short medial bristle with long proximal hairs and 2 spinous terminal bristles. End joint with 4 small bristles either with short marginal spines or bare, 9 longer bristles with long proximal and short distal spines, and 2 long, plumose, posterior bristles; 4 posterior bristles of end joint separated by space from more anteriorly positioned bristles; endites III and IV and end joint hirsute.

*Seventh Limb* (Figure 23*f*): Limb with 37 bristles: 8 proximal and 12 terminal on comb side; 6 proximal and 11 terminal on peg side; bristles with 1–6 bells. Terminus consisting of comb with 7 elongate teeth (outer tooth on each side slightly shorter and with flatter tip) and 5 or 6 short flat-tipped teeth forming row on each side of elongate teeth; peg opposite comb similar in shape and length to elongate teeth of comb.

*Furca* (Figure 22*f*): Right lamella slightly anterior to left; each lamella with 9 claws decreasing in length and breadth posteriorly along lamella; claw 2 fused to lamella, others separated from lamella by suture; all claws with teeth along posterior margins; claws 1–4 with hairs along distal anterior margins.

*Bellonci Organ* (Figure 23*g*): Short, cylindrical, with rounded tip.

*Eyes:* Medial eye small, unpigmented (Figure 23*g*). Lateral eyes absent.

*Upper Lip* (Figure 23*h*): Unpaired anteroventral part with fairly large glandular pegs; paired tusks well developed and with glandular pegs similar in size to those of unpaired part; posterior lobes of lip evenly rounded, hirsute.

*Genitalia:* Rounded lobe on each side of body with attached oval spermatophore.

*Posterior of Body:* Similar to that of adult male.

*Y-Sclerite:* Similar to that of juvenile.

DESCRIPTION OF ADULT MALE (Figures 24*c–f*, 25).—Carapace higher than that of female and with slightly shorter caudal process.

*Infold and Selvage:* Not examined.

*Size:* USNM 193170, length 3.29 mm, height 2.26 mm.

*First Antenna* (Figure 25*a*): Joints 1–5 similar to those of female. 6th joint with short bare medial bristle. 7th joint: a-bristle bare, about twice length of bristle of 6th joint; b-bristle almost twice length of a-bristle, with short, stout, proximal filament (with rounded proximal process followed by large sucker and then smaller process near pointed tip), and 2 slender distal filaments (proximal filament with 4 minute discs, distal with 5; minute pointed process present on each filament proximal to discs); c-bristle with short, stout, proximal filament (with rounded proximal process followed by large sucker and then small process near pointed tip), 2 slender distal filaments (each with minute pointed process followed by 5 or 6 minute discs), followed by 6 slender filaments (with minute marginal spines) and bifurcate tip; sucker of c-bristle larger than that of b-bristle. 8th joint similar to that of female.

*Second Antenna* (Figure 24*d*): Protopodite and endopodite similar to those of female. Exopodite: bristle of 2nd joint without proximal dorsal spine, otherwise similar to that of female; joints 2–8 with small basal spines increasing in size on distal joints; basal spine of 8th joint reaching to mid-length of 9th joint; lateral spine of 9th joint consisting of single prong (about $^2/_3$ length of joint) with 3 or 4 small terminal spines; exopodite otherwise similar to that of female.

*Mandible* (Figure 25*b*): Similar to that of female.

*Maxilla:* Cutting tooth of 1st endopodial joint with 3 or 4 cusps; both limbs of USNM 193170 with 4 a-bristles on 2nd endopodial joint; limb otherwise similar to that of female.

*Fifth Limb* (Figure 24*e,f*): 1st exopodial joint with 1 short bristle near anterior group of 3 bristles (Figure 24*f*); 4th exopodial joint with 3 or 4 bristles; limb otherwise similar to that of female.

*Sixth Limb:* Similar to that of female.

*Seventh Limb* (Figure 25*d*): Limb with 34 or 35 bristles: 5 or 6 proximal and 12 terminal on comb side; 4 proximal and 12 terminal on peg side; bristles similar to those of adult female. Terminal comb and peg similar to those of adult female.

*Furca:* USNM 193171 differs from furca of adult female in having only 7 claws and a wider space between 2nd and 3rd claws.

*Bellonci Organ* (Figure 25*e*): Similar to that of adult female.

*Eyes:* Medial eye small unpigmented (Figure 25*e*). Lateral eyes absent.

*Upper Lip* (Figure 25*f*): Similar to that of adult female.

*Genitalia:* An elongate, oval, copulatory organ on each

FIGURE 25.—*Rheina prex*, new species, adult male, paratype, USNM 193170: *a*, right 1st antenna, medial view; *b*, left mandible, medial view; *c*, 7th limb; *d*, terminal comb and peg of 7th limb; *e*, medial eye and Bellonci organ; *f*, anterior process and upper lip; *g*, posterodorsal part of body showing marginal ridges dorsal to posterior end of girdle (stippled).

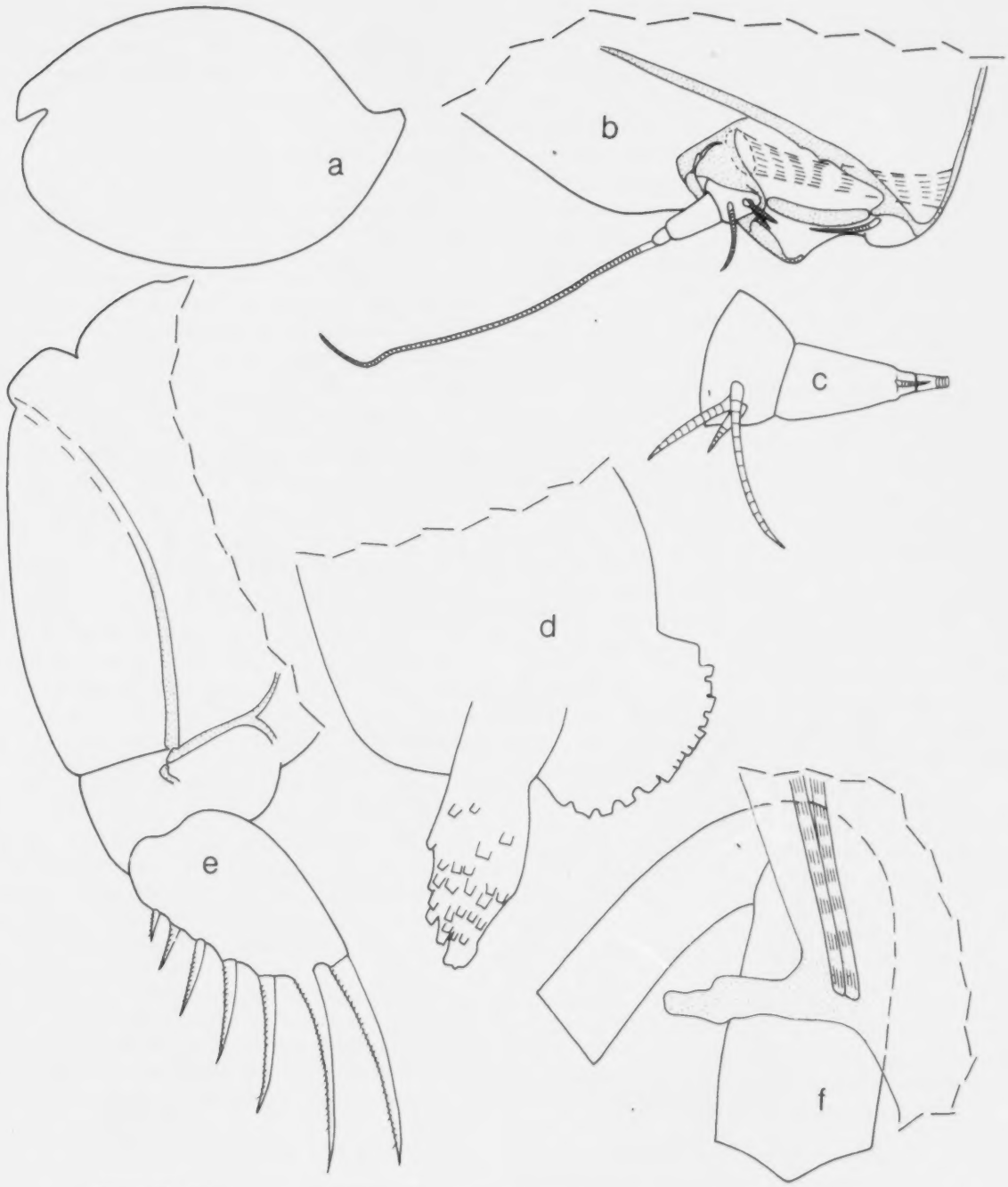



FIGURE 26.—*Rheina prex*, new species, instar IV, paratype, USNM 193171: *a*, complete specimen from left side, length 2.42 mm; *b*, distal part of protopodite and endopodite of left 2nd antenna; *c*, endopodite of right 2nd antenna, medial view; *d*, upper lip; *e*, posterior of body showing right lamella of furca, Y-sclerite and girdle (stippled), and 2 of the ridges of posterodorsal margin dorsal to girdle; *f*, fused medial eye and Bellonci organ showing medial eye muscles extending to dorsal margin of valve, and joints 1 and 2 of right 1st antenna.

side of body (tip not reaching base of claw 1 of furca).

*Posterior of Body* (Figure 25*g*): Posterodorsal part with 7 undivided ridges.

Y-*Sclerite:* Similar to that of juvenile.

DESCRIPTION OF INSTAR IV (A-2; sex unknown; Figure 26).—Carapace similar in shape to that of adult female.

*Infold:* Not examined.

*Selvage:* Similar to that of adult female.

*Size:* USNM 193171, length 2.42 mm, height 1.64 mm.

*First Antenna:* Joints 1–4 similar to those of adult female. Sensory bristle of 5th joint with 6 long proximal filaments followed by 2 slender filaments and bifurcate tip. Medial bristle of 6th joint about same length as joint. 7th joint: a-bristle spinous, about twice length of bristle of 6th joint; b-bristle only slightly longer than a-bristle, with 3 short proximal filaments; c-bristle extending well past sensory bristle of 5th joint, with 6 short proximal filaments (some with marginal spines) and bifurcate tip. 8th joint: d- and e-bristles about twice length of a-bristle, bare with blunt tips; f-bristle about 3/4 length of c-bristle, with 5 or 6 proximal filaments (some with marginal spines) and bifurcate tip; g-bristle slightly longer than f-bristle, with 6 proximal filaments (some with marginal spines) and bifurcate tip.

*Second Antenna* (Figure 26*b,c*): Protopodite with short bare bristle. Endopodite 3-jointed: 1st joint with 3 bristles (1 longer than others); 2nd joint bare on one limb of USNM 193171 and with a short bristle on other; short 3rd joint with long terminal bristle. Exopodite: ventral margin of bristle of 2nd joint with 11 or 12 stout spines; bristles of joints 3–8 with natatory hairs and without spines; 9th joint obscure on specimen studied.

*Mandible:* Similar to that of adult female.

*Maxilla:* Cutting tooth of 1st endopodial joint with only 3 cusps; limb otherise similar to that of adult female.

*Fifth Limb:* Endites and protopodite similar to those of adult female. Main tooth of 1st exopodial joint consisting of stout rounded peg and 4 pectinate teeth; spinous bristle proximal to peg; anterior 3 bristles with long proximal hairs. 2nd exopodial joint with 3 pectinate a-bristles, 5 pectinate b-bristles, 1 short c-bristle and 1 long d-bristle, both with long proximal and short distal spines. Except for 4th joint having only 2 bristles (1 bare, other with short spines), exopodial joints 3–5 similar to those of adult female.

*Sixth Limb:* Two fairly long bare bristles in place of epipodite. Endite I with 1 short, plumose, medial bristle and 1 long, spinous, terminal bristle; endite II with 3 short medial bristles (2 plumose, 1 with few spines), and 2 terminal bristles (1 long, spinous, other short, bare); endite III with 1 plumose medial bristle, and 3 terminal bristles (2 with long proximal and short distal spines, 1 with short spines), endite IV with 1 short, proximal, medial bristle and 2 spinous, terminal bristles. End joint with 1 small lateral bristle with short marginal spines, 8 or 9 longer bristles with long proximal and short distal spines, and 2 long, plumose, posterior bristles; posterior 5 bristles separated by space from more anteriorly positioned bristles; endites III and IV and end joint hirsute.

*Seventh Limb:* Each limb with 10 or 11 strongly tapering, terminal bristles and no proximal bristles; each bristle with only 1 bell; clapper of terminal bell similar in structure to bell but smaller and with distal end oblique. Terminus with elongate peg, and with 5 elongate teeth projecting perpendicularly from surface and not forming comb.

*Furca* (Figure 26*e*): Each lamella with 7 claws; claw 2 fused to lamella.

*Bellonci Organ* (Figure 26*f*): Less well defined than in adults.

*Eyes:* Medial eye less well developed than in adults (Figure 26*f*). Lateral eyes absent.

*Upper Lip* (Figure 26*d*): Similar to those of adults.

*Genitalia:* Not observed.

*Posterior of Body* (Figure 26*e*): Posterodorsal part with 7 distinct ridges as on adult male.

Y-*Sclerite* (Figure 26*e*): Typical for subfamily.

### *Bathyvargula* Kornicker, 1968

*Bathyvargula* Poulsen, 1962:215 [nomen nudum].—Kornicker, 1968:442.

TYPE SPECIES.—*Bathyvargula parvispinosa*, Poulsen, 1962 (designation by Kornicker, 1968:442).

DISTRIBUTION.—*Bathyvargula parvispinosa* is from the West Indies at a depth of 900 m, and *B. walfordi* is from the Tasman Sea at a depth of 610 m (Poulsen, 1962:216, 222).

COMPOSITION.—The genus comprises 2 species, *B. parvispinosa* Poulsen, 1962:216, and *B. walfordi* Poulsen, 1962:222.

DISCUSSION.—The genera *Bathyvargula* and *Metavargula* differ primarily in the former having no or few indistinct spines on the bristle of the 2nd exopodial joint of the 2nd antenna and the latter having many distinct spines on that bristle. That difference seems of insufficent magnitude to warrent recognition of 2 genera. However, relatively few genera of the Cypridininae are known from the deep sea, so I find it expedient to recognize both genera at this time. Males of both known species of *Bathyvargula* have broad paddle-like proximal filaments on the sensory bristle of the 5th joint of the 1st antenna. Males are known for only 5 of the 10 species (including 3 new species described herein) that have been referred to *Metavargula;* all have broad paddle-like proximal filaments on the sensory bristle of the 1st antenna. That character is probably a synapomorphy that might be useful for future regrouping of species now referred to *Bathyvargula* and *Metavargula.*

### *Bathyvargula parvispinosa* Poulsen, 1962

FIGURE 27

*Bathyvargula parvispinosa* Poulsen, 1962:216, figs. 103, 104.

HOLOTYPE.—Mature male, Zoological Museum, Copenhagen, Denmark.

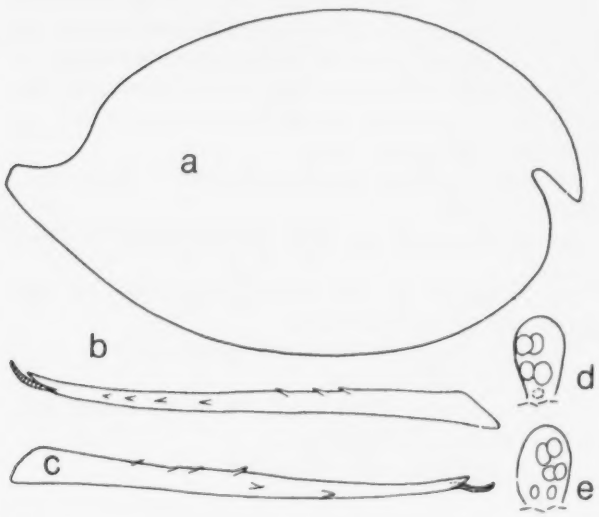



FIGURE 27.—*Bathyvargula spinosa* Poulsen, adult or A-1 female, paratype: *a*, complete specimen from right side, length 2.57 mm; *b*, *c*, bristles of 2nd exopodial joint of left and right 2nd antennae; *d*, *e*, left and right lateral eyes.

TYPE LOCALITY.—West Indies, St. Croix, off Frederiksted, 900 m (Poulsen, 1962:216).

MATERIAL.—One specimen borrowed from the Zoological Museum, Copenhagen. Vial with label, "*Bathyvargula parvispinosa* E.M. Poulsen; Loc. Frederiksted, W. Indies 900 m; Female paratype; Datum: 18 Jan 1906; Legit: Th. Mortensen; Det. EMP 1962." Specimen without eggs.

DISTRIBUTION.—Only collected at type locality.

SUPPLEMENTARY DESCRIPTION (Figure 27).—Carapace elongate with projecting caudal process below valve midheight (Figure 27*a*).

*Size:* Length 2.57 mm, height 1.61 mm. Poulsen (1962:216) gave length range of 3 female paratypes without larvae as 2.62–2.87 mm; the specimen examined herein is probably the smallest of Poulsen's specimens.

Second Antenna (Figure 27*b,c*).—Bristle of 2nd exopodial joint just reaching 7th joint, with 3 or 4 faint proximal spines, 2–4 extremely faint distal spines, and 1 stout terminal spine. Remarks: Except for terminal spine, bristle appears bare at low magnification (× 10–20 objective). The proximal spines are just visible with × 40 objective, and the distal spines were barely visible using oil objectives of either ×50 or ×100. The spines did not appear to be restricted to the ventral margin of the bristle.

*Seventh Limb:* Each limb with 13 bristles, 4 proximal (2 on each side), and 9 distal (4 or 5 on each side).

*Furça:* Each lamella with 8 claws.

*Lateral eye* (Figure 27*d,e*): With 4–6 ommatidia.

REMARKS.—Limbs described above of the specimen examined are similar to those of the female described by Poulsen (1962:216–221) except for the presence of marginal spines on the bristle of the 2nd exopodial joint of the 2nd antenna. The spines are minute and faint and perhaps were overlooked on the specimens examined by Poulsen. I did not observe genitalia or spermatophores on the specimen examined, but the bristles of the 7th limb are cylindrical indicating that the specimen is either an A-1 female, or is an adult as stated by Poulsen (1962:216, and on label in vial).

## GIGANTOCYPRIDININI Hartmann, 1974

The tribe contains only the genus *Gigantocypris* Müller, 1895.

### *Gigantocypris* Müller, 1895

TYPE SPECIES.—*Gigantocypris agassizii* Müller, 1895:164 (subsequent designation by Sylvester-Bradley, 1961:Q398).

DISTRIBUTION.—Widespread, pelagic, generally at bathyal and abyssal depths (Poulsen, 1962, fig. 2).

COMPOSITION.—Two species of *Gigantocypris* have been reported from the Bay of Biscay, *G. muelleri* Skogsberg, 1920, and *G. dracontovalis* Cannon, 1940, (Angel and Forsham, 1975:736). Only the former species was in the present collections.

### *Gigantocypris muelleri* Skogsberg, 1920

*Gigantocypris Mülleri* Skogsberg, 1920:202–219, figs. 26–29.
*Gigantocypris mülleri.*—Cannon, 1940:185–244 figs. 1–17, pls. 39–42.—Poulsen, 1962:57–84, figs. 26–41.—Tibbs, 1965:481.
*Gigantocypris muelleri.*—Poulsen, 1969:130.—Kornicker, 1976:47–48; 1985:410–412.—Kornicker et al., 1976:16–31, figs. 15–20.—Moguilevsky and Gooday, 1977:263–269, figs. 1, 2.—Moguilevsky, 1985:159–163, figs. 1–5.
*Gigantocypris mulleri.*—Angel and Fasham, 1975:736.—Chavtur, 1983:32.

HOLOTYPE.—None selected.

SYNTYPE LOCALITY.—Atlantic and Antarctic Oceans between latitudes of 60°N and 60°S (Skogsberg, 1920:218).

MATERIAL.—BIOGAS IV, R.V. *Jean Charcot*, sta 1: sample CP-02, 1 specimen. Sta 6: sample CV-33, 1 specimen. BIOGAS VI, R.V. *Jean Charcot*, sta 2: sample DS-73, 1 specimen; sample CP-12, 1 juvenile. Sta 3: sample CP-13, 2 specimens. Sta 4: sample DS-79, 1 specimen; sample CP-15; 1 specimen; sample CP-17, 2 specimens; sample CP-18, 1 specimen. Sta 5: sample CP-21, 1 juvenile; sample CP-21a, 1 juvenile; sample CP-22, 1 female with unextruded eggs. BIOGAS VII, R.V. *Cryos*, sta 1: sample CP-28, 1 specimen. BIOGAS IX, R.V. *Capricorne*, sta 1: sample CP-32, 2 specimens (USNM 193245); sample CP-33, 2 specimens; sample CP-34, 1 specimen.

NORATLANTE. Sta 49: sample B-21, 1 specimen.

DISTRIBUTION.—Based on present samples depth range in

and west of the Bay of Biscay was 1152–4721 m, but Moguilevsky and Gooday (1977:264) collected the species at shallower depths (700 m), and it has been collected as shallow as 150 m elsewhere (Skogsberg, 1920:218).

DISCUSSION.—Specimens in the BIOGAS and NORATLANTE samples are mostly late juveniles. Only a specimen from BIOGAS VI, sample CP-22, contained eggs (unextruded and small). The carapace of the specimen is distorted but its length is about 16 mm, which suggests that it is an adult. The 7th limb has about 90 bristles on each side, and the comb has about 45 teeth on each side. According to the key to species of *Gigantocypris* in Poulsen (1962:22), the specimen is *G. danae* Poulsen, 1962:85, rather than *G. muelleri*. The number of bristles on the 7th limb is slightly lower than the lower range given by Poulsen (1962:102) for *G. muelleri* (111 bristles) and G. danae (105 bristles). Because *G. danae* has not been reported in the Atlantic, and because insufficient adult specimens were available for studying variability, I find it expedient to consider the specimen to be a variant of *G. muelleri*. Many of the juveniles in the collection have carapaces too large for their inclusion in *G. dracontovalis*.

CORRECTION.—Kornicker et al. (1976:21) in presenting a supplementary description of a female of *G. muelleri* collected near Bermuda stated that there are 52 teeth in the comb of the 7th limb. It should have read: there are 52 teeth on each side of the comb.

## AZYGOCYPRIDININAE Kornicker, 1970

This subfamily comprises 2 genera, *Azygocypridina* Sylvester-Bradley, 1950, and *Isocypridina* Kornicker, 1975a; only the former genus is known in the North Atlantic.

### *Azygocypridina* Sylvester-Bradley, 1950

*Azygocypridina* Sylvester-Bradley, 1950:11 [nomen novum].

TYPE SPECIES.—*Crossophorus imperator* Brady, 1880:158, by monotypy.

DISTRIBUTION.—Members of this genus are widespread in the world's oceans between recorded depths of 139–2930 m, but most species cover only part of that depth range.

COMPOSITION.—Only 1 species was recognized in the North Atlantic by Athersuch (1980), *A. imperialis* Brady, 1880, and in that publication he presented a supplementary description of the species and discussed its ontogeny and sexual dimorphism. In the present collections the species was fairly abundant in and west of the Bay of Biscay and the specimens provided the opportunity to add some details to our knowledge of the species.

### *Azygocypridina imperialis* (Stebbing, 1901)

FIGURES 28–34

*Crossophorus imperator*.—Brady and Norman, 1896:643, pl. 53: figs. 1–10.—Scharff, 1897:76 [list]. —Müller, 1912:20 [key]. [Not *C. imperator* Brady, 1880:158.]

*Crossophorus imperialis* Stebbing, 1901:100.

*Crossophorus grimaldii* Granata, 1919:1, figs. 1–7.—Granata and Caporiacco, 1949:5, fig. 1, pl. 2: figs. 1–12.—Belloc, 1961:2.

*Azygocypridina imperialis* (Stebbing).—Sylvester-Bradley, 1950:364.—Kornicker, 1970:10; 1975a, table 22; 1985:409–412 [excluding specimens from samples DS-41 and CP-13, which are referred to *Metavargula quintuplex* and *Gigantocypris muelleri*, respectively, herein].—Athersuch, 1980:145, figs. 1–11.—Chavtur, 1983:37.

HOLOTYPE.—Juvenile female, instar IV, British Museum (Natural History) Norman collection, 1911.11.8.3901 (appendage slide); 1911.11.8.36759 (left valve in alcohol).

TYPE LOCALITY.—North Atlantic, west of Ireland, 55°11′N, 11°3′W, 144 fms (2638.5 m).

MATERIAL.—BIOGAS I, R.V. *La Perle*, sta Hors-Zone: sample DS-09, 1 instar I; sta 1: sample DS-13, 1 adult female. POLYGAS, R.V. *Jean Charcot*, sta 1: sample DS-15, 1 early instar (USNM 193267); sta 6: sample DS-25, 1 early instar (USNM 193270); sample DS-26, 1 early instar (USNM 193268). BIOGAS II, R.V. *Jean Charcot*, sta 2: sample DS-31: 1 adult female + 1 adult male (USNM 193238) + 1 instar II (USNM 193235) + 12 juveniles (instar I to IV). BIOGAS III, R.V. *Jean Charcot*, sta 6: sample DS-50: 1 instar I. BIOGAS IV, R.V. *Jean Charcot*, sta 1: sample DS-63, 1 adult male. Sta 2: sample DS-57, 1 adult female; sample DS-59, 1 instar I + 1 instar I + 1 instar II (USNM 193236); sample CV-38, 1 instar V (USNM 193242); sample Na-04, 2 instar IV. Sta 6: sample DS-51, 3 instar I; sample DS-52, 1 instar I. BIOGAS VI, R.V. *Jean Charcot*, sta 2: sample DS-74, 2 instar I. Sta 6: sample DS-87, 1 ovigerous female (USNM 193237) + 1 instar I + 1 instar I (USNM 193234). BIOGAS VII, R.V. *Cryos*, sta 2: sample NA-20: 1 instar III. BIOGAS VIII, R.V. *Noroit*, sta 1: sample KG-151: 1 ovigerous female. BIOGAS IX, R.V. *Capricorne*, sta 2: sample KG-172, 1 adult female; sample KG-173, 1 instar IV (USNM 193240); sample KG-176, 1 instar III (USNM 193239); sample KG-178, 1 instar III + 1 instar IV; sample KG-185, 1 adult female.

NORATLANTE. Sta 44: sample B-15, 1 instar I. Sta 48: sample B-19, 1 adult male (USNM 193243); sample E-16, 1 ovigerous female + 1 instar I + 1 instar IV female (all 3: USNM 193244) + 1 instar V (USNM 193241).

DISTRIBUTION.—Eastern Atlantic between 21°N and 60°N at depths of 1900–2930 m. In the Bay of Biscay between depths of 1884–2828 m.

SUPPLEMENTARY DESCRIPTION OF ADULT FEMALE (Figures 28*a–e*, 31–34).—Carapace oval in lateral view with small rostrum and incisur.

*Size:* USNM 193237 length 9.0 mm, height 7.5 mm; USNM 193244, length 9.00 mm, height 7.2 mm. Athersuch (1980:158) listed length range of 21 specimens as 8.33–10.13 mm.

*First Antenna:* 1st joint bare. 2nd joint with 1 distal lateral bristle, dorsal margin with 20 bristles, ventral margin with 7 bristles. 3rd joint with 15 distal dorsal bristles (3 with bases

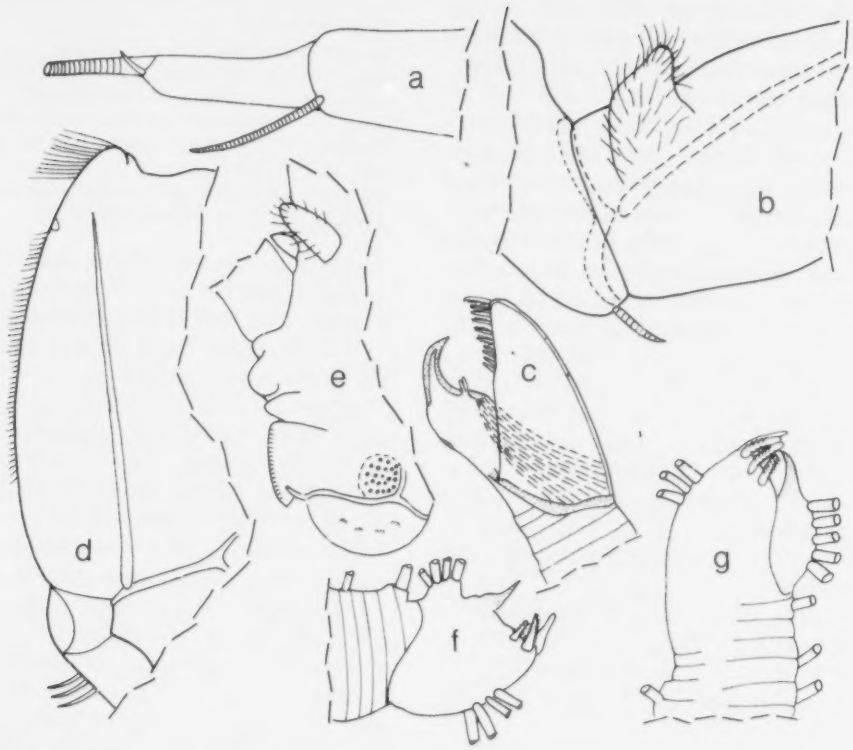



FIGURE 28.—*Azygocypridina imperialis* (Stebbing), ovigerous female, USNM 193237, length 9.0 mm: *a*, endopodite of left 2nd antenna, medial view; *b*, left mandible, lateral view of distal end of coxale showing hirsute process near dorsal margin, and proximal part of basale showing small bristle on ventral margin (sclerites dashed); *c*, tip of 7th limb (bristles not shown); *d*, posterior of body showing marginal hairs and spines, proximal 3 claws of furca, Y-sclerite and girdle; *e*, anterior of body showing left lateral eye, Bellonci organ, proximal part of 1st joint of 1st antenna, and upper lip; *f*, adult male, USNM 193288, tip of 7th limb; *g*, adult male, USNM 193243, tip of 7th limb.

on lateral side and pointing backwards) and 3 distal ventral bristles. 4th joint with 5 terminal dorsal bristles and 5 terminal ventral bristles (proximal of these pointing backwards). Sensory bristle of 5th joint with abundant long filaments (about 50) along proximal half and many short filaments along distal half (about 10 of these concentrated at tip). 6th joint with slender, bare, medial bristle about same length as combined lengths of 5th and 6th joints. 7th joint: a-bristle about same length as bristle of 6th joint, linear, strongly sclerotized, with small distinct marginal spines; b-bristle about 1 1/2 length of a-bristle, shorter than sensory bristle of 5th joint, with numerous short filaments (many concentrated at tip); c-bristle about twice length of b-bristle, with 20 short filaments evenly spaced along bristle. 8th joint: d-and e-bristles about same length but d-bristle slightly thinner; both bristles with blunt tips reaching just past tip of b-bristle; f-bristle slightly longer than c-bristle, with about 23 short filaments evenly spaced along bristle; g-bristle similar to c-bristle except slightly longer. 2nd joint narrower and slightly shorter than 1st; 3rd joint about same width and 3/4 length of 2nd, dorsal margin longer than ventral; 4th joint about 2/3 length of 3rd, with short dorsal margin; 5th joint about same length as maximum length of 4th; 6th joint and fused 7th and 8th joints short and narrow.

*Second Antenna:* Protopodite with distal medial bristle. Endopodite 3-jointed (Figure 28*a*): 1st joint with 10–12 ventral bristles forming 2 groups, each with 5–7 bristles; 2nd joint elongate, with 1 terminal, inner bristle; 3rd joint about same length as 1st, with small, unringed, terminal bristle (not present on all specimens) and long, ringed, filament with blunt tip (filament 1 2/3 length of stem). Exopodite: 1st joint with numerous minute spines forming short rows; bristle of 2nd joint reaching well past 9th joint, with abundant marginal hairs (hairs shorter and more closely spaced than those of natatory bristles of other joints); joints 3–8 with long bristles with natatory hairs; 9th joint with 7 bristles (6 long, 1 short), all with natatory hairs; joints 2–8 with slender basal spines increasing in length on distal joints; basal spine of 8th joint about same as maximum length of 9th joint; 9th joint with 2

FIGURE 29.—*Azygocypridina imperialis* (Stebbing), ovigerous female, USNM 193327, tip of 7th limb.

slender spines shorter than joint, several minute spines, and medial suture at proximal ventral corner bearing 1 of the 7 bristles on joint; joints 2–8 with minute spines along distal margins.

*Mandible* (Figure 28*b*): Coxale endite with numerous slender spines and 2 stout, pectinate, terminal spines; lateral surface of coxale with distal hirsute process (not sclerotized) near dorsal margin (Figure 28*b*). Basale: medial surface of proximal ventral corner with 2 stout pectinate bristles and 6 short slender bristles; ventral margin proximal to midlength with 7 slender bristles (1 longer than others), some with bases on medial and lateral surfaces; ventral margin just distal to midlength with 1 very long stout bristle with abundant marginal spines; dorsal margin with 1 long bristle distal to midlength followed by 7 bristles forming row extending onto medial side of joint, then 2 long subterminal bristles; medial surface near midheight with long hairs forming clusters in row. Exopodite hirsute, extending past distal end of dorsal margin of 1st endopodial joint, with 2 distal ventral bristles (distal of these about 1/2 length of other). 1st endopodial joint with 9 ventral bristles (1 stout lateral, 4 stout medial, 2 small medial, 2 small lateral). 2nd endopodial joint: ventral margin with 9 bristles forming 2 oblique rows (1 medial with 5 bristles, 1 lateral with 4 bristles); dorsal margin with abundant bristles. End joint with short dorsal claw, 2 long terminal claws, and 4 bristles.

*Maxilla:* Endite 1 with 20 spinous and pectinate bristles (3 of these medial and small); endite II with about 14 slender, proximal, spine-like bristles and 9 stout, terminal, pectinate and spinous bristles; endite III not examined in detail. Basale with 1 stout medial bristle near base of exopodite and 9 slender bristles at anterior distal corner. Coxale and exopodite fragmented on limb examined. Endopodite: 1st joint with 7 slender alpha-bristles and 4 beta-bristles (only outer stout bristle pectinate, others bare); cutting tooth absent (inner distal corner of 1st joint smoothly rounded); end joint with 7 slender, bare, a-bristles, 4 pectinate b-bristles, 5 slender, pectinate, c-bristles, and 4 pectinate d-bristles (inner 3 b-bristles and inner 3 d-bristles unringed, claw-like).

*Fifth Limb:* Endites I to III with numerous spinous bristles. Exopodite: main tooth of 1st joint with proximal spinous bristle followed by pointed peg and 6 pectinate teeth; anterior side of 1st joint with 6–8 bristles forming row proximal to main tooth and 5–7 more proximal bristles near midwidth of joint; 2nd joint with 6 a-bristles (all but posterior 2 pectinate), 4 pectinate b′-bristles, 5 long, stout b″-bristles, 1 spinous c-bristle, and 1 hirsute d-bristle; inner lobe of 3rd joint with 8 bristles, outer lobe of 3rd joint hirsute, with 2 bristles, both with long proximal hairs and short distal spines; 4th joint with 9 bristles; 5th joint with proximal and distal lobes (distal lobe could be interpreted as a 6th joint); proximal lobe with 7 bristles; distal lobe with 10 bristles; inner lobe of 3rd joint and joints 4 and 5 with fewer hairs than on outer lobe of 3rd joint.

*Seventh Limb* (Figures 28*c*, 29, 31–34): Each limb with 74–81 bristles: 14–21 on terminal segment (5–10 on comb side, 9–13 on jaw side), and 60 proximal (23 or 24 on comb side, 36 or 37 on jaw side); bristles varying in diameter and length, but all slender and tapering; small bristles with 2–4 bells; long bristles with up to 9 bells, but usually not more than 8; part of bristles proximal to bells with marginal spines. Terminal comb with 12–18 teeth (10 or 11 spinous teeth forming row and no or 1–4 shorter bare teeth on each side); jaw opposite comb forming large hook with up to 6 straight pegs at proximal end (some limbs without pegs). Muscle for closing jaw attached to both inner proximal end of hook and to sclerite at base of terminal segment; distal inner end of sclerite forms pivot for jaw at proximal inner end of comb margin proximal to comb (Figure 28*c*). Length of limb of USNM 193244: 5.7 mm.

*Furca* (Figure 33): Claw 1 of right lamella anterior to claw 1 of left lamella; claw 1 shorter than claw 2 and offset. Left lamella of USNM 193237 with 24 claws. Starting with claw

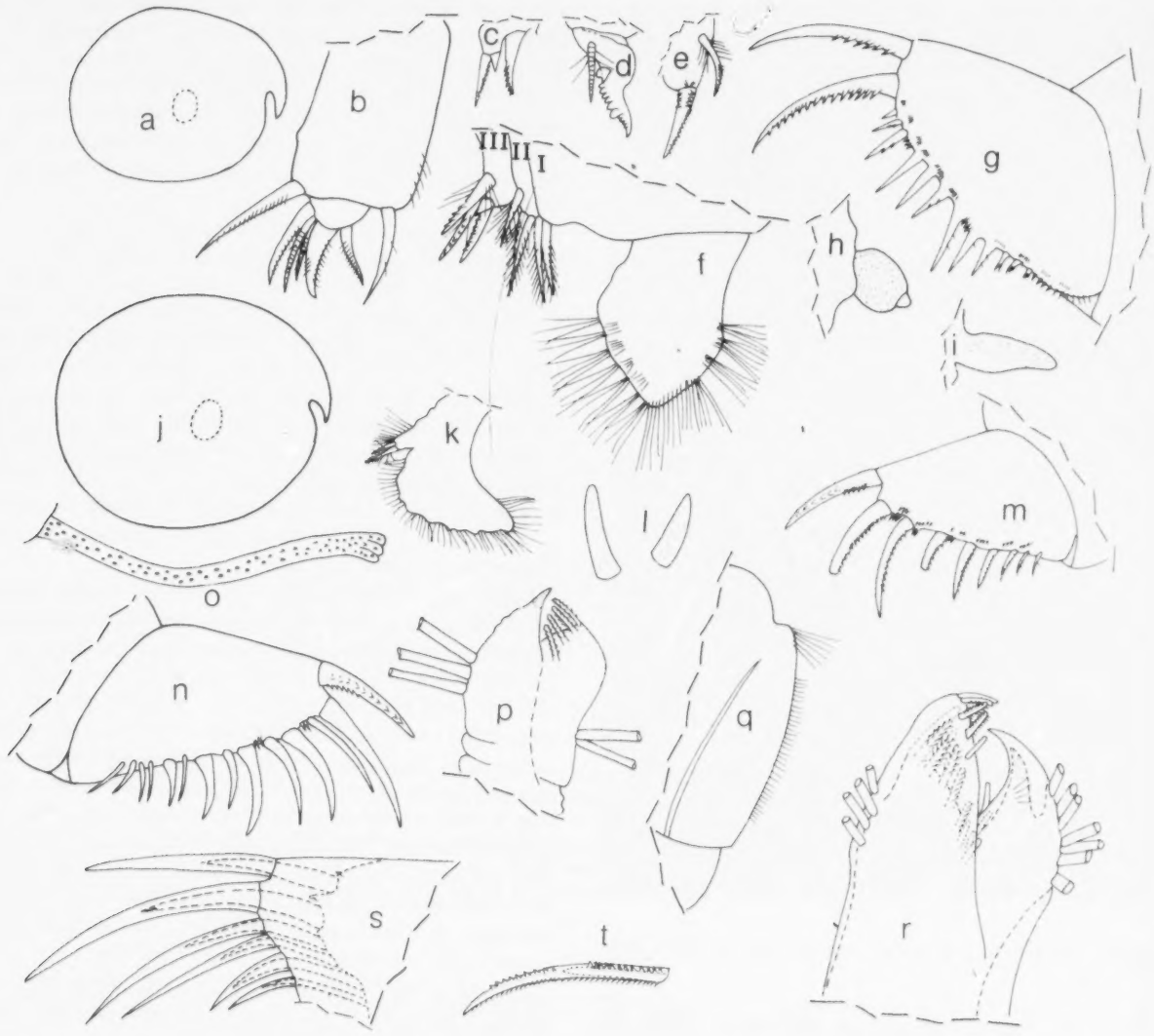



FIGURE 30.—*Azygocypridina imperialis* (Stebbing), instar I, USNM 193234: *a*, complete specimen from right side showing location of central adductor muscle attachment scars (dashed oval), length 2.60 mm; *b*, endopodite of left maxilla, medial view. *c–e*, right 5th limb, posterior view: *c*, endite III; *d*, main tooth and bristle of 1st exopodial joint; *e*, tooth and bristle of 2nd exopodial joint; *f*, endites of left 5th limb, and left 6th limb, lateral view; *g*, left lamella of furca. Instar I, BIOGAS III, sta 6, sample DS-50, length 2.70 mm: *h*, Bellonci organ; *i*, right lateral eye. Instar II, USNM 193236: *j*, complete specimen from right side showing location of central adductor muscle attachment scars (dashed oval), length 3.41 mm; *k*, left 6th limb, lateral view; *l*, left and right 7th limbs; *m*, left lamella of furca. Instar III, USNM 193239, length 3.96 mm: *n*, right lamella of furca; *o*, 7th limb. Instar IV, USNM 193240, length 5.00 mm: *p*, tip of 7th limb; *q*, posterior of body. Instar V, USNM 193241, length 6.2 mm: *r*, tip of 7th limb showing within it the 7th limb of the adult; *s*, distal part of left lamella of furca showing within it the left lamella of the adult; *t*, claw 2 of right lamella of furca showing within it the adult claw.

2, claws arranged in 8 groups with claws decreasing in length and diameter in each group.

| | *Number of claws in each group* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII |
| Left lamella | 4 | 2 | 2 | 2 | 3 | 2 | 2 | 6 |

*Bellonci Organ* (Figure 28*e*): Short with minute process at tip.

*Eyes:* Each lateral eye elongate, flap-like with marginal hairs and without ommatidia. Medial eye not observed.

*Upper Lip* (Figure 28*e*): Narrow anterior part with numerous glandular openings; ventral part comprising 2 lobes

bearing minute spines forming short rows; lateral surface proximal to ventral margins with sclerotized frame having short dorsal branch forming posterior edge of oval area bearing numerous minute glandular openings.

*Genitalia:* With opaque white sphere (probably spermatophore).

*Posterior of Body* (Figure 28*d*): Posterior dorsal to furca hirsute; posterodorsal corner with low process bearing abundant long hairs.

Y-*Sclerite* (Figure 28*d*): With short ventral branch.

*Eggs:* USNM 193237 with 47 elliptical eggs in marsupium (measurements of largest and smallest egg: length 0.98 mm, height 0.73 mm; length 0.91 mm, height 0.67 mm). Specimen from KG-151, measurements of egg selected at random, length 1.19 mm, height 0.97 mm. Egg from USNM 193244, length 1.08 mm, height 0.81 mm.

SUPPLEMENTARY DESCRIPTION OF ADULT MALE (Figures 28*f,g*, 31).—Shape similar to that of adult female.

*Size:* Smaller than female. 2 specimens (USNM 193238 and specimen from DS-63): length 7.2 mm, height 6.0 mm. Athersuch (1980:158) listed length range of 44 specimens as 6.98–7.65 mm.

*Second Antenna:* 9th exopodial joint with 7 bristles.

*Fifth Limb:* 1st exopodial joint with 6 pectinate teeth on main tooth.

*Seventh Limb* (Figures 28*f,g*, 31): Each limb with 43–57 bristles: 8 or 9 in terminal segment (3 or 4 on comb side, 4–6 on jaw side), and 35–48 proximal bristles (14–18 on comb side, 21–30 on jaw side); bristles varying in length and diameter but all slender and tapering; bristles with 2–7 bells; part of bristles proximal to bells with marginal spines. Terminal comb with 4 or 5 spinous teeth; jaw opposite comb forming sclerotized linear or slightly recurved process. Length of limb of specimen from DS-31, 4.48 mm; length of limb of specimen from NORATLANTE B-19, 5.25 mm.

*Furca:* Claw 1 of right lamella anterior to claw 1 of left lamella; claw 1 shorter than claw 2 and offset on lamella. Right lamella of USNM 193243 with 22 claws. Starting with claw 2, claws arranged in 6 groups.

| | *Number of claws in each group* | | | | | |
|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI |
| Right lamella | 3 | 3 | 3 | 3 | 2 | 7 |

DESCRIPTION OF INSTAR 1 (sex unknown, Figures 30*a–i*, 33).—Posteroventral corner of shell less rounded than posterodorsal corner, shape otherwise similar to that of adult female (Figure 30*a*).

*Size:* USNM 193234, length 2.60 mm, height 2.08 mm. Athersuch (1980:158) listed length range of 4 specimens as 2.50–2.72 mm.

*First Antenna:* 1st joint bare. 2nd joint with short spines along ventral margin and long hairs along dorsal margin (neither spines nor hairs present on adult 2nd joint). 3rd joint with 2 bare bristles near midlength (1 ventral, 1 dorsal). 4th joint bare, dorsal margin about half length of ventral margin. Sensory bristle of 5th joint long with minute spine at tip. Medial bristle of 6th joint bare, about same length as combined lengths of 5th and 6th joints. 7th joint: a-bristle about same length as bristle of 6th joint, linear with few ventral spines, less sclerotized than a-bristle of 5th joint; b-bristle slightly longer than sensory bristle of 5th joint, bare except for minute spine at tip; c-bristle about 1/4 longer than sensory bristle and less than twice length of a-bristle, bare except for minute spine at tip. 8th joint: d- and e-bristles about same length but d-bristle slightly thinner, almost twice length of b-bristle, tips tapering to point; f-bristle about same length as c-bristle, bare except for minute spine at tip; g-bristle longer than c-bristle, bare except for minute spine at tip.

*Second Antenna:* Protopodite with distal medial bristle. Endopodite 3-jointed: 1st joint with several long hairs but without bristles (hairs not present on adult 1st joint); 2nd joint elongate with 1 terminal inner bristle; 3rd joint about same length as 1st joint, with 1 long ringed filament with blunt tip (filament 2.7 times length of stem; relatively longer than on adult). Exopodite: 1st joint with minute spine-like medial bristle near midheight of distal margin (joint without spines present on adult female; adult without medial bristle); 9th joint differing from that of adult female in having only 2 bristles and in not having medial suture at proximal ventral corner; joints 2–9 with spines similar to those of adult female.

*Mandible:* Coxale with endite and dorsal process similar to those of adult female. Basale: medial surface of proximal ventral corner with 2 stout pectinate bristles and 1 short slender bristle; ventral margin proximal to midlength with 2 slender bristles; dorsal margin with 3 slender bristles (1 distal to midlength and 2 subterminal); medial surface with long hairs forming clusters in row near midheight. Exopodite with hirsute tip reaching well past distal end of dorsal margin of 1st endopodial joint, and with 2 distal ventral bristles (distal of these about 3/4 length of other). 1st endopodial joint with 2 ventral bristles (1 with long spines, 1 with short spines). 2nd endopodial joint: ventral margin with single subterminal bristle with spines along distal margin; medial spines forming row on joint near base of subterminal bristle; dorsal margin with 9 bristles near midlength. End joint with 2 long terminal claws and 2 bristles (lateral bristle reaching past midlength of claws, medial bristle almost length of claws).

*Maxilla* (Figure 30*b*): Endite I broad, with 6 spinous terminal bristles; endite II narrow, with 4 spinous and pectinate bristles; endite III narrow and short, with 4 spinous and pectinate bristles (3 terminal, 1 proximal). Coxale with long, stout, hirsute, dorsal bristle, and with dorsal hairs on flap. Basale with 2 ventral bristles near base of exopodite. Exopodite reaching past midlength of 1st endopodial joint, with 3 bristles (1 on outer margin distal to midlength, 2 terminal; only marginal bristle hirsute, others bare or with minute spines); outer margin of exopodite hirsute. 1st endopodial joint with slender alpha-bristle with few short marginal spines, and 1 stout, pectinate, beta-bristle; anterior margin of joint with few long hairs; posterior margin with small protuberance (tooth?)

near midlength. End joint with 2 slender alpha-bristles with few spines, and 1 pectinate claw-like b-bristle, c-bristle, and d-bristle.

*Fifth Limb:* Epipodial appendage with 76 spinous bristles. Endite I with 2 spinous bristles (Figure 30*f*); endite II with 3 spinous and pectinate bristles; endite III with 3 or 4 bristles (2 or 3 spinous and pectinate, 1 short, bare, pointed) (Figure 30*c,f*). 1st exopodial joint with main tooth comprising small pointed peg and pectinate tooth having broad proximal part and 6 large marginal teeth followed by 4 small teeth (Figure 30*d*); bristle proximal to peg with long proximal and short distal marginal spines; anterior side with bristle bearing long proximal and short distal marginal spines; posterior side with bristle bearing long proximal spines and small distal teeth. 2nd exopodial joint with single a-bristle with 3 or 4 paired small teeth proximally and 10 or 11 small teeth forming single row distally (Figure 30*e*); small rounded tooth proximal to a-bristle; single b-bristle with long proximal hairs and small distal teeth; single c-bristle with long proximal and short distal spines; d-bristle absent. 3rd joint without inner lobe and with 2 terminal bristles (with long proximal and short distal spines) on outer lobe. 4th exopodial joint with small spinous process on inner distal margin near 5th joint. 5th exopodial joint hirsute, with 2 terminal bristles (outer with long proximal and short distal spines, inner with only short spines); 4th and 5th joints separated by suture.

*Sixth Limb* (Figure 30*f*): Consisting of unsegmented flap without sutures or endites; margin along distal half with long hairs forming clusters (hairs more numerous along posterior than anterior).

*Seventh Limb:* Absent.

*Furca* (Figures 30*g*, 33): Claw 1 of right lamella slightly anterior to claw 1 of left lamella. Claw 1 separated from lamella by suture; posterior edge with teeth forming 2 rows; a lateral row with 7 proximal teeth, and a medial row of 16 teeth (distal teeth larger than proximal teeth). Claw 2 about 1/3 longer than claw 1 and separated from lamella by suture; posterior edge with teeth forming a lateral and a medial row with teeth along full length of claw (distal teeth slightly longer than proximal teeth). Claws 3–5 small, with all (or at least claws 3 and 4) separated from lamella by suture, and with few small teeth along posterior margin; claws decreasing in length posteriorly along lamella. Claws 6–8 and 9–10 or 9–11 forming 2 groups, each decreasing in length posteriorly along lamella; all claws fused to lamella and with very few spines along posterior edges. Several spines, some bifurcate, present on lamella following claw 10 (right lamella) or claw 11 (left lamella). Spines present between some claws and laterally on lamellae proximal to claws. A small spine present on anterior margins of lamellae proximal to claw 1.

*Bellonci Organ* (Figure 30*h*): Similar to that of adult.

*Eyes:* Lateral eyes similar to those of adult (Figure 30*i*). Medial eye not observed.

*Upper Lip:* Similar to that of adult.

*Posterior of Body:* Posterior dorsal to furca hirsute; posterodorsal corner evenly rounded and with long hairs.

*Y-Sclerite:* Similar to that of adult.

DESCRIPTION OF INSTAR II (sex unknown; Figures 30*j–m*, 33, 34).—Carapace similar in shape to that of adult female; posteroventral corner not less rounded than posterdorsal corner as on instar I (Figure 30*j*).

*Size:* USNM 193235, length 3.46 mm, height 2.82 mm; USNM 193236, length 3.41 mm, height 2.83 mm. Athersuch (1980:158) listed length range of 8 specimens as 2.90–3.52 mm.

*First Antenna:* 1st joint bare. 2nd joint with few hairs along ventral margin and 4 bristles (1 ventral, 2 dorsal, 1 lateral). 3rd joint with 1 ventral bristle at midlength and 2 dorsal bristles (1 at midlength, 1 distal to midlength). 4th joint with dorsal margin about half length of ventral margin, with 2 bare bristles (1 dorsal, terminal, 1 ventral, subterminal). Sensory bristle of 5th joint with 7 long proximal filaments and 5 shorter distal filaments. Medial bristle of 6th joint bare, about same length as combined lengths of 5th and 6th joints. 7th joint: a-bristle about same length as bristle of 6th joint, with more marginal spines than a-bristle of instar I, linear, appearing less sclerotized than a-bristle of adult female; b- and c-bristles with marginal filaments. 8th joint: d- and e-bristles differ from those of instar I in having blunt tips; c-, f-, g-bristles with marginal filaments.

*Second Antenna:* Protopodite similar to that of instar I. Endopodite differs from that of instar I in having a bristle on 1st joint. Exopodite differs from that of instar I in not having a small medial bristle on distal margin of 1st joint, and in having 3 bristles on 9th joint.

*Mandible:* Coxale similar to that of instar I. Basale: medial surface of proximal ventral corner with 2 stout pectinate bristles and 2 short slender bristles; ventral margin proximal to midlength with 4 slender bristles; ventral margin just distal to midlength with 1 very long stout bristle with abundant marginal spines (this bristle absent on instar I); dorsal margin with 3 bristles as on instar I; medial suface near midheight with long hairs forming clusters in row. Exopodite similar to that of instar I. 1st endopodial joint with 3 ventral bristles (1 with short spines, 2 with long spines). 2nd endopodial joint: ventral margin with 3 subterminal bristles (distal with spines along distal margin, others with spines along both margins); dorsal margin with about 15 bristles near midlength; medial surface with small spines forming rows. End joint with short dorsal claw, 2 long terminal claws, and 3 bristles.

*Maxilla:* Endite I with 6 spinous bristles; endite II with 10 short proximal bristles and about 6 spinous terminal bristles; endite III with 2 long proximal anterior bristles and about 6 spinous terminal bristles. Coxale, basale, and exopodite similar to those of instar I. 1st endopodial joint differs from that of instar I in having 2 alpha-bristles, and in not having a small protuberance along posterior margin near midlength. End joint with 3 a-bristles, 1 claw-like b-bristle, and a total of 4 c- and

d-bristles (3 claw-like).

*Fifth Limb:* Endite I with 5 spinous bristles; endite II with 6 spinous and pectinate bristles; endite III with 5 spinous and pectinate bristles. 1st exopodial joint differs from that of instar I in main tooth having additional pectinate tooth (marginal teeth of similar size on each tooth, not with large proximal and short distal teeth as on instar I); anterior side of joint with 1 or 2 bristles (outer stout, pectinate, inner, when present, with long proximal and short distal spines) proximal to main tooth, and 1 hirsute bristle near d-bristle of 2nd joint. 2nd exopodial joint with 2 pectinate a-bristles, 2 pectinate b′-bristles, and 3 pectinate b″-bristles: posterior c-bristle similar to that of instar I; anterior side with hirsute d-bristle; 3rd exopodial joint with 2 bristles on inner lobe and 2 on outer lobe. 4th exopodial joint hirsute with 2 bristles. 5th exopodial joint hirsute with 4 bristles; 4th and 5th joints separated by suture. Small spinous process on 4th exopodial joint of instar I represented on instar II by spines but no process.

*Sixth Limb* (Figure 30*k*): Single endite spinous and with 2 bristles bearing long marginal spines at midlength. End joint with long spines on uneven distal margin and on medial and lateral surfaces; posterior tip of joint forming small lobe.

*Seventh Limb* (Figures 30*l*, 33, 34): Forming small bare process. Length 0.15–0.18 m (limbs of USNM 193236).

*Furca* (Figures 30*m*, 33): Differs from that of instar I in having fewer claws and in that all claws are separated from lamella. Each lamella with 8 or 9 claws; claw 1 shorter than claw 2; remaining claws decreasing in length and width posteriorly along lamella. Claw 1 of right lamella slightly anterior to claw 1 of left lamella; claw 1 with 5 proximal teeth on posterior lateral margin, and 12 medial teeth (largest of these near midlength); claws 2–7 with bases laterally on lamella a slight distance from its ventral edge. Small spines present between claws and on lateral surface of lamella near claws.

*Bellonci Organ, Upper Lip, Y-Sclerite:* Similar to those of adult.

*Eyes:* Not observed.

*Posterior of Body:* Posterior dorsal to furca hirsute; posterodorsal corner with long hairs.

DESCRIPTION OF FEMALE INSTAR III (Figures 30*n*, 33, 34).—Carapace similar in shape to that of adult female.

*Size:* USNM 193239, length 3.96 mm, height 3.35 mm. Athersuch (1980:158) lists the length of 1 specimen as 4.22 mm.

*First Antenna:* 1st joint bare. 2nd joint with 11 bristles (4 ventral, 6 dorsal, 1 lateral). 3rd joint with 2 ventral bristles just distal to midlength and 4 dorsal bristles (2 near midlength, 2 distal). 4th joint with dorsal margin about $^2/_3$ length of ventral margin, with 4 bare bristles (2 ventral, 2 dorsal). Sensory bristles of 5th joint with 11 long proximal filaments and 7 slender distal filaments. Bristles of joints 6–8 not examined in detail but of similar type to those of adult female.

*Second Antenna:* Protopodite similar to those of earlier instars and the adult female. Endopodite differs from that of instar II in having 3 bristles on the 1st joint. Exopodite differs from that of instar II in having 4 bristles on 9th joint.

*Mandible:* Coxale similar to those of earlier instars and the adult female. Basale: medial surface of proximal ventral corner with 2 stout pectinate bristles and 3 short slender bristles; ventral margin proximal to midlength with 4 slender bristles; ventral margin distal to midlength with 1 very long stout bristle with abundant marginal spines; dorsal margin with 1 long bristle distal to midlength and 2 long subterminal bristles; medial surface with 2 long bristles with bases just distal to midlength, and with long hairs forming clusters in row near midheight. Exopodite similar to that of instar II. 1st endopodial joint with 5 ventral bristles. 2nd endopodial joint: ventral margin with 5 subterminal bristles; dorsal margin with about 17 bristles near midlength; medial surface with minute spines forming rows. End joint with short dorsal claw, 2 long terminal claws, and 3 bristles.

*Maxilla:* Endite I broad with 11 spinous bristles; endite II narrower, with about 10 short proximal bristles and 6 terminal spinous and pectinate bristles; endite III similar in width to II but slightly shorter, with 3 anterior bristles and 6 spinous and pectinate terminal bristles. Coxale and exopodite similar to those of instar II. Basale with 1 stout bristle near base of exopodite and 2 slender bristles at anterior distal corner. Endopodite: 1st joint with 3 slender alpha-bristles and 2 beta-bristles (1 long, pectinate, 1 short, bare); end joint with 4 a-bristles, 2 b-bristles, 2 c-bristles, and 3 d-bristles.

*Fifth Limb:* Endite I with 8 spinous bristles; endite II with 9 spinous and pectinate bristles; endite III with about 11 bristles; 1st exopodial joint with main tooth consisting of small pointed peg and 3 stout pectinate teeth (1 more than instar II); usual posterior bristle present proximal to peg; anterior side of joint with 3 bristles forming row (inner bristle bare, middle bristle with long proximal hairs, outer bristle longer and stouter than others and pectinate); 2 additional hirsute anterior bristles present closer to midwidth of limb and proximal to row of 3 bristles described above (the 2 bristles may be on protopodite). 2nd exopodial joint with 3 pectinate a-bristles, 2 b′-bristles, 2 b″-bristles, 1 hirsute c-bristle, and 1 hirsute d-bristle. 3rd exopodial joint with 3 bristles (1 short, hirsute, proximal, 2 longer terminal; 1 of latter hirsute, other pectinate) on inner lobe and 2 hirsute terminal bristles on hirsute outer lobe. 4th exopodial joint with 2 bristles, and separated from 5th joint by weak suture. 5th exopodial joint divided into 2 lobes, with 2 bristles on inner edge of proximal lobe and 6 distal bristles on terminal lobe.

*Sixth Limb:* Limb with 4 well-developed endites. Endite 1 with or without 1 spinous bristle; endite II with 4 or 5 bristles; endite III with 8 bristles; endite IV with 6 bristles. End joint with 18 or 19 bristles; posterior end of ventral margin with small lobe. 3 bristles in place of epipodite.

*Seventh Limb* (Figures 30*o*, 33, 34): Elongate, bare, slender, small. Length, 0.69 mm (limb of specimen from KG-176).

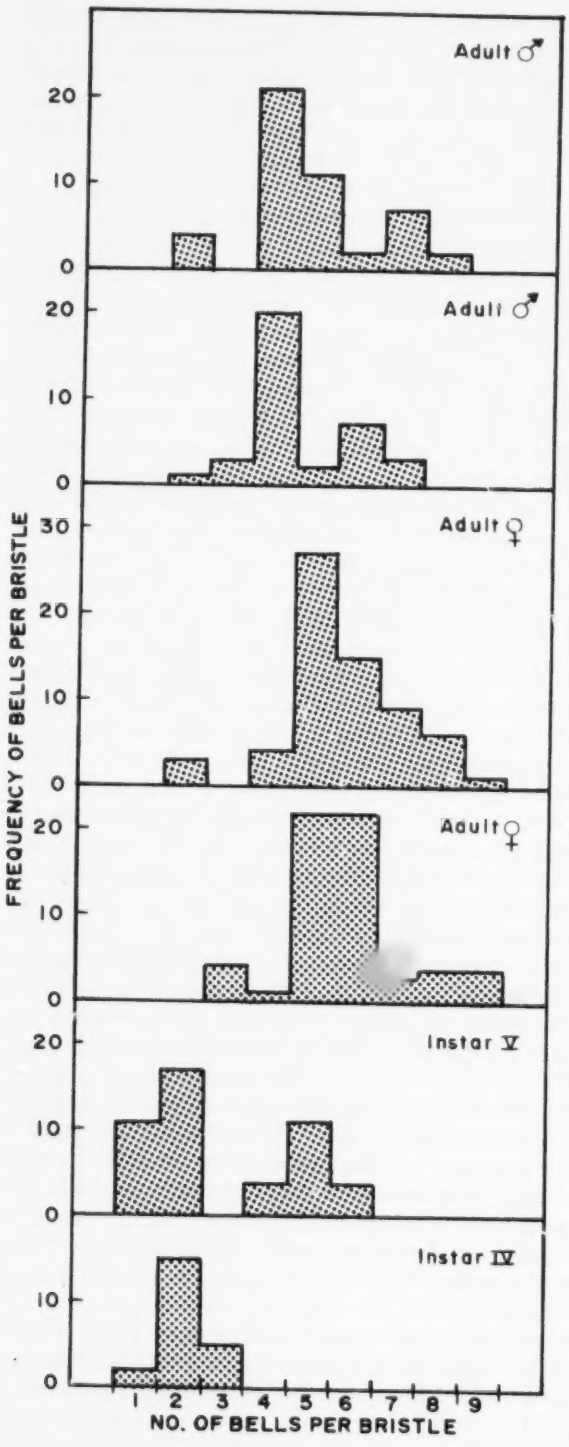



FIGURE 31.—Frequency of bells per bristle on 7th limbs of *Azygocypridina imperalis* (Stebbing) (adult male and female data from left and right limbs of same specimen; juvenile data from single limb of a specimen).

*Furca* (Figures 30*n*, 33): Claw 1 of right lamella anterior to claw 1 of left lamella; length of claw 1 4/5 that of claw 2. Lamellae of USNM 193239 with 14 claws. Starting with claw 2 claws arranged in 5 groups with claws decreasing in length and diameter in each group.

| | *Number of claws in each group* | | | | |
|---|---|---|---|---|---|
| | I | II | III | IV | V |
| Left lamella | 2 | 2 | 2 | 2 | 5 |
| Right lamella | 2 | 2 | 2 | 2 | 5 |

DESCRIPTION OF INSTAR IV (Figures 30*p,q*, 31, 33, 34).—Carapace similar in shape to that of adult female.

*Size:* USNM 193240, length 5.00 mm, height 4.30 mm.

*First Antenna:* 1st joint bare. 2nd joint with few small proximal spines on ventral margin, and 10 bristles (2 ventral, 7 dorsal, 1 lateral). 3rd joint with 7 or 8 bristles (2 ventral, 5 or 6 dorsal). 4th joint with dorsal margin about half length of ventral margin, with 4 bare bristles (2 ventral, 2 dorsal). Sensory bristle of 5th joint with about 27 long proximal filaments and 6 shorter distal filaments. Bristles of joints 6-8 not examined in detail but of similar type to those of adult female.

*Second Antenna:* Protopodite similar to that of instar III. Endopodite differs from that of instar III in having 1st joint with 5 bristles and 3rd joint with minute terminal bristle in addition to the long filament. Exopodite differs from that of instar III in having 5 bristles on 9th joint.

*Mandible:* Coxale similar to that of adult female. Basale: medial surface of proximal ventral corner with 2 stout pectinate bristles and 4 short slender bristles; ventral margin and medial and lateral sides near ventral margin with 6 proximal slender bristles; ventral margin distal to midlength with 1 very long stout spinous bristle; dorsal margin with 1 long bristle distal to midlength, 3 slender bristles with bases on medial surface, and 2 long subterminal bristles; medial surface of joint just dorsal to midheight with long hairs forming clusters. Exopodite similar to that of adult female. 1st endopodial joint with 7 bristles (4 long, 2 medium, 1 very short). 2nd endopodial joint: ventral margin with 7 bristles forming 2 oblique rows (proximal with 3 bristles, distal with 4 bristles; bristles of proximal group with bases extending onto medial side; some bristles of distal group with bases on lateral side very close to ventral margin; dorsal margin with numerous bristles near midlength. End joint with short dorsal claw, 2 long claws, and 4 bristles.

*Maxilla, Sixth Limb:* Not examined in detail but general morphology similar to those of adult female.

*Fifth Limb:* Bristles of endites with numerous spinous bristles. 1st exopodial joint with main tooth comprising small pointed peg and 4 pectinate teeth; 1 spinous bristle proximal to peg; anterior side of joint with 3 bristles forming row proximal to main tooth; 3 additional hirsute bristles present at about midwidth, closer to d-bristle (these could be on protopodite). 2nd exopodial joint with 4 pectinate a-bristles, 2

pectinate b′-bristles, 4 pectinate b″-bristles, 1 hirsute c-bristle, and 1 hirsute d-bristle. 3rd exopodial joint with 5 bristles on inner lobe and 2 hirsute bristles on hirsute outer lobe; 4th exopodial joint with 6 bristles on inner margin and few long hairs. 5th joint with proximal and distal lobes divided partly by suture extending about half way through joint; proximal lobe with 5 bristles; distal lobe hirsute, with 9 bristles.

*Seventh Limb* (Figures 31, 33, 34): Elongate, length of limb of USNM 193240, 1.87 mm. Limb with 21 bristles: 5 in terminal segment (2 on comb side, 3 on jaw side); bristles slender and tapering and bearing 1–3 bells (most with 2) part of bristles proximal to bells with few marginal spines. Terminal comb with 7 long spinous teeth; jaw opposite comb with pointed and slightly recurved, weakly sclerotized tip.

*Furca* (Figure 33): Similar to that of instar III but with more claws. Lamellae of USNM 193240 with 18 or 19 claws. Starting with claw 2 claws arranged in 5 groups with claws decreasing in length and diameter in each group.

*Number of claws in each group*

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| Left lamella | 3 | 3 | 2 | 2 | 7 |
| Right lamella | 3 | 3 | 3 | 3 | 6 |

*Posterior of Body* (Figure 30*g*): Posterior dorsal to furca with long hairs; posterodorsal corner forming "step" and bearing long spines.

DESCRIPTION OF FEMALE INSTAR V (Figures 30*r–t*, 31–34).—Carapace similar in shape to that of adult female.

*Size:* USNM 193242, length 7.0 mm, height 6.0 mm; USNM 193241, length 6.2 mm, height 6.0 mm. Athersuch (1980:158) listed the length range of 9 specimens as 6.50–7.65 mm.

*First Antenna:* Sensory bristle of 5th joint with about 15 long proximal filaments and about 10 shorter distal filaments.

*Second Antenna:* Endopodite differs from that of instar IV in having 6 or 7 bristles on 1st joint; 3rd joint with or without small bristle. Exopodite with 6 bristles on 9th joint.

*Fifth Limb:* 1st exopodial joint differs from that of instar IV in having main tooth with 5 pectinate teeth; anterior side with 5 bristles forming row proximal to main tooth, 5 bristles forming row near midwidth of joint, and 2 slender bristles forming row slightly proximal to previous row (these could be on protopodite). 2nd exopodial joint with 5 pectinate a-bristles, 4 pectinate b′-bristles, and 3 b″-bristles, 1 hirsute c-bristle and 1 hirsute d-bristle. 3rd exopodial joint with 8 bristles (1 proximal, 7 terminal) on inner lobe and 2 hirsute bristles on hirsute outer lobe. 4th exopodial joint hirsute, with 7 bristles, and separated from 5th by suture. 5th exopodial joint divided into 2 hirsute lobes partly separated by suture; proximal lobe with 5 bristles, distal lobe with 10 bristles.

*Seventh Limb* (Figures 30*r*, 31–34): Each limb with 53 bristles: 11 in terminal segment (4 on comb side, 7 on jaw side), and 42 proximal (15 on comb side, 27 on jaw side) bristles varying in diameter and length but all slender and tapering; bristles with 1–6 bells and few marginal spines. Terminal comb with 10 spinous teeth forming row; jaw opposite comb forming large hook with single smooth peg at proximal inner end. Length of limb of USNM 193241, 3.7 mm.

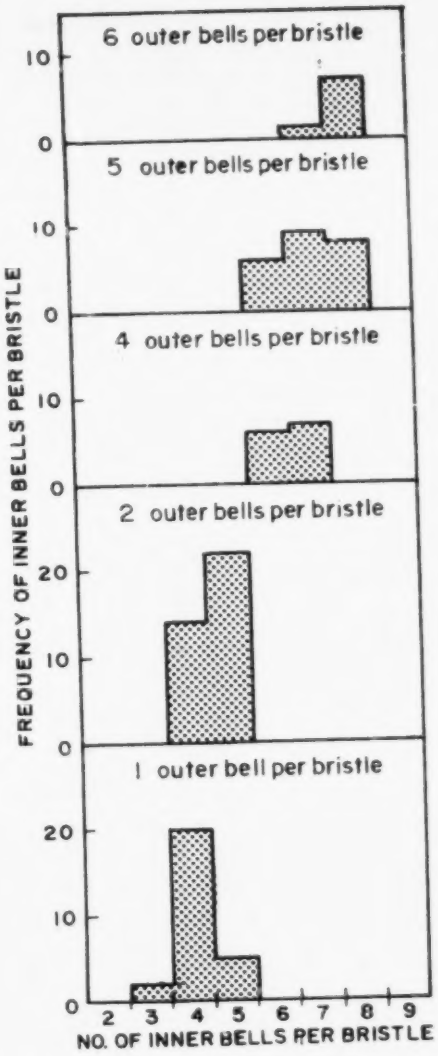

6 outer bells per bristle
5 outer bells per bristle
4 outer bells per bristle
2 outer bells per bristle
1 outer bell per bristle
FREQUENCY OF INNER BELLS PER BRISTLE
NO. OF INNER BELLS PER BRISTLE
0
10
20
2 3 4 5 6 7 8 9

FIGURE 32.—Frequency of inner bells on bristles of the 7th limb of an adult visible within the 7th limb of an instar V female (USNM 193241) of *Azygocypridina imperialis* (Stebbing).

*Furca* (Figure 30*s,t*): Claw 1 of right lamella anterior to claw 1 of left lamella; claw 1 shorter than claw 2 and offset. Left lamella of USNM 193241 with 19 claws and right lamella with 20 claws. Starting with claw 2, claws arranged in 6 groups decreasing in length and diameter in each group.

*Numbers of claws in each group*

| | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|
| Left lamella | 3 | 3 | 2 | 2 | 2 | 6 |
| Right lamella | 3 | 2 | 2 | 3 | 2 | 7 |

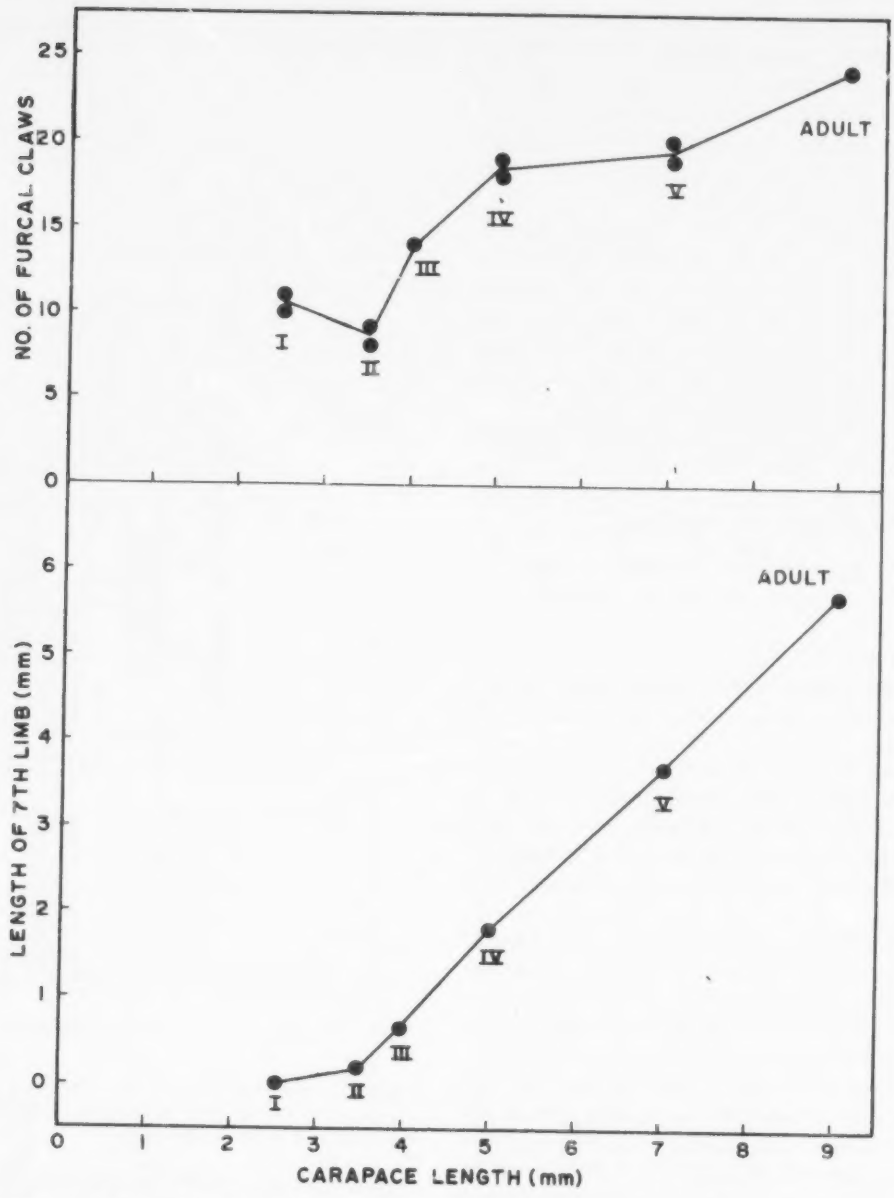



FIGURE 33.—Number of furcal claws and length of 7th limb as a function of carapace length during ontogeny of *Azygocypridina imperialis* (Stebbing).

SUPPLEMENTARY DESCRIPTION OF HOLOTYPE.—Carapace consisting of torn, decalcified single valve; flattened valve with length of 6.0 mm and height of 5.7 mm (in vivo the valve would be arched and, therefore, the length and height would be smaller than the measurements of the flattened valve).

*First Antenna* (left limb only): 1st joint bare. 2nd joint with 14 bristles (4 ventral, 8 dorsal, 2 lateral). 3rd joint with 9 bristles (2 ventral, 7 dorsal). 4th joint with short dorsal margin and 6 bristles (3 ventral, 3 dorsal). Sensory bristle of 5th joint with about 23 long proximal filaments and about 10 shorter and thinner distal filaments. Bristle of 6th joint medial, about same length as combined dorsal margins of joints 5 and 6. 7th joint: a-bristle linear, pointed, sclerotized; b-bristle slightly shorter than sensory bristle of 5th joint and about twice length of a-bristle, with short filaments; c-bristle about twice length of sensory bristle, with many short filaments. 8th joint: d- and e-bristles bare, about same length as b-bristle; f- and g-bristles similar to c-bristle except slightly longer.

TABLE 7.—*Azygocypridina imperialis:* Comparison of morphology of selected characters of instars I-V and adults. (Sex on instars I and II unknown; characters given are from specimens studied herein; abbreviations: F = Female, M = Male, + = 7th limb/bristles present, – = 7th limb/bristles absent, na = not applicable.)

| Character | I | II | III | IV | V | Adult | |
|---|---|---|---|---|---|---|---|
| | | | F | F | F | F | M |
| Carapace length (mm) | 2.55 | 3.41 | 3.96 | 5.00 | 7.00 | 9.0 | 7.2 |
| height (mm) | 2.33 | 2.83 | 3.35 | 4.30 | 6.00 | 7.5 | 6.0 |
| 1st antenna | | | | | | | |
| 2nd joint (ventral/dorsal) | –/– | +/+ | +/+ | +/+ | +/+ | +/+ | +/+ |
| 3rd joint (ventral/dorsal) | +/+ | +/+ | +/+ | +/+ | +/+ | +/+ | +/+ |
| 4th joint (ventral/dorsal) | –/– | +/+ | +/+ | +/+ | +/+ | +/+ | +/+ |
| Sensory filaments of bristles | – | + | + | + | + | + | + |
| 2nd antenna (number of bristles) | | | | | | | |
| Endopodite | | | | | | | |
| 1st joint | 0 | 1 | 3 | 5 | 6–7 | 10–12 | 9 |
| 2nd joint | 1 | 1 | 1 | 1 | 1 | 1 | 12 |
| 3rd joint | 1 | 1 | 1 | 2 | 1–2 | 1–2 | 3 |
| Exopodite 9th joint | 2 | 3 | 4 | 5 | 6 | 7 | 7 |
| 5th limb, number of pectinate teeth comprising main tooth | 1 | 2 | 3 | 4 | 5 | 6 | 6 |
| 6th limb, number of bristles | 0 | 2 | 40 | many | many | ~109 | many |
| 7th limb | – | + | + | + | + | + | + |
| Number of bristles | na | 0 | 0 | 21 | 53 | 74–81 | 43–57 |
| Number of bells on bristles | na | na | na | 1–3 | 1–6 | 2–9 | 2–7 |
| Number of comb teeth | na | 0 | 0 | 7 | 10 | 12–18 | 4–5 |
| Number of teeth at base of jaw | na | na | na | 0 | 1 | 0–6 | 0 |
| Furca, number of claws on lamella | 10–11 | 9 | 14 | 18 | 19–20 | 24 | 22 |

*Second Antenna* (left limb only): Protopodite with distal medial bristle. Endopodite 3-jointed: 1st joint with 5 short bristles; 2nd joint with short distal bristle; 3rd joint with long terminal filament. Exopodite: 9th joint with 5 bristles; bristle of 2nd joint reaching just past 9th joint and with numerous small marginal spines; basal spines present on most joints.

*Mandible:* Coxale endite spinous with 2 stout terminal prongs. Basale: medial surface of proximal ventral corner with 2 stout pectinate bristles and 5 short slender bristles; ventral margin and lateral side near ventral margin with 6 proximal slender bristles; ventral margin distal to midlength with 1 very long stout spinous bristle; dorsal margin with 1 long bristle distal to midlength, 3 slender bristles with bases on medial surface, and 2 long subterminal bristles. Exopodite reaching past distal end of 1st endopodial joint, with 2 distal bristles (inner more than twice length of outer). 1st endopodial joint with 6 ventral bristles. 2nd endopodial joint: ventral margin with 6 or 7 subterminal bristles; dorsal margin with numerous bristles near midlength. End joint with short dorsal claw, 2 long terminal claws, and bristles.

*Maxilla:* Exopodite well developed, hirsute, with 1 subterminal and 2 terminal bristles (subterminal bristle hirsute and shorter than others). 1st endopodial joint with 3 slender alpha-bristles and 3 beta-bristles (outer stout pectinate).

*Fifth Limb:* Main tooth of 1st exopodial joint comprising small pointed peg and 4 pectinate teeth.

*Sixth Limb* (single limb): With 4 endites bearing bristles and end joint with numerous bristles. Posterior lobe of end joint not well developed. Epipodial bristles obscure.

*Seventh Limb* (1 limb only): Elongate with about 18 bristles. Terminal comb obscure but with about 5 spinous teeth; jaw recurved, sclerotized.

*Furca* (Figure 33): Each lamella with 20 or 21 claws. Claw 1 smaller than claw 2 and offset. Starting with claw 2, claws arranged in 6 groups with claws decreasing in length and diameter in each group.

*Number of claws in each group*

| | I | II | III | IV | V | $VI_1$ |
|---|---|---|---|---|---|---|
| Left lamella | 3 | 3 | 3 | 2 | 2 | 6 |
| Right lamella | 3 | 3 | 3 | 2 | 2 | 7 |

STAGES OF DEVELOPMENT (Table 7).—The exopodite of the 2nd antenna has 2 bristles on the 9th joint of instar I and adds 1 bristle for each succeeding stage (Athersuch, 1980:157). The 5th limb of instar I has 1 pectinate tooth comprising the main tooth of the 1st exopodial joint and adds 1 pectinate tooth for each succeeding stage (the pectinate tooth of instar I has large proximal teeth forming row proximal to smaller teeth forming row; whereas, later instars do not have this subdivision). The 1st antenna of only instar I is without bristles on the 2nd joint, and is without marginal filaments on the sensory bristle of the 5th joint as well as the b-, c-, f-, and g-bristles of joints 7 and 8. The 6th limb is represented by a spinous flap without bristles on instar I, bears 2 endite bristles on instar II, and many bristles on succeeding instars. The 7th limb is absent on instar I, is represented by a small, thumb-like process on instar II, is elongate and bare on instar III, and bears many bristles on

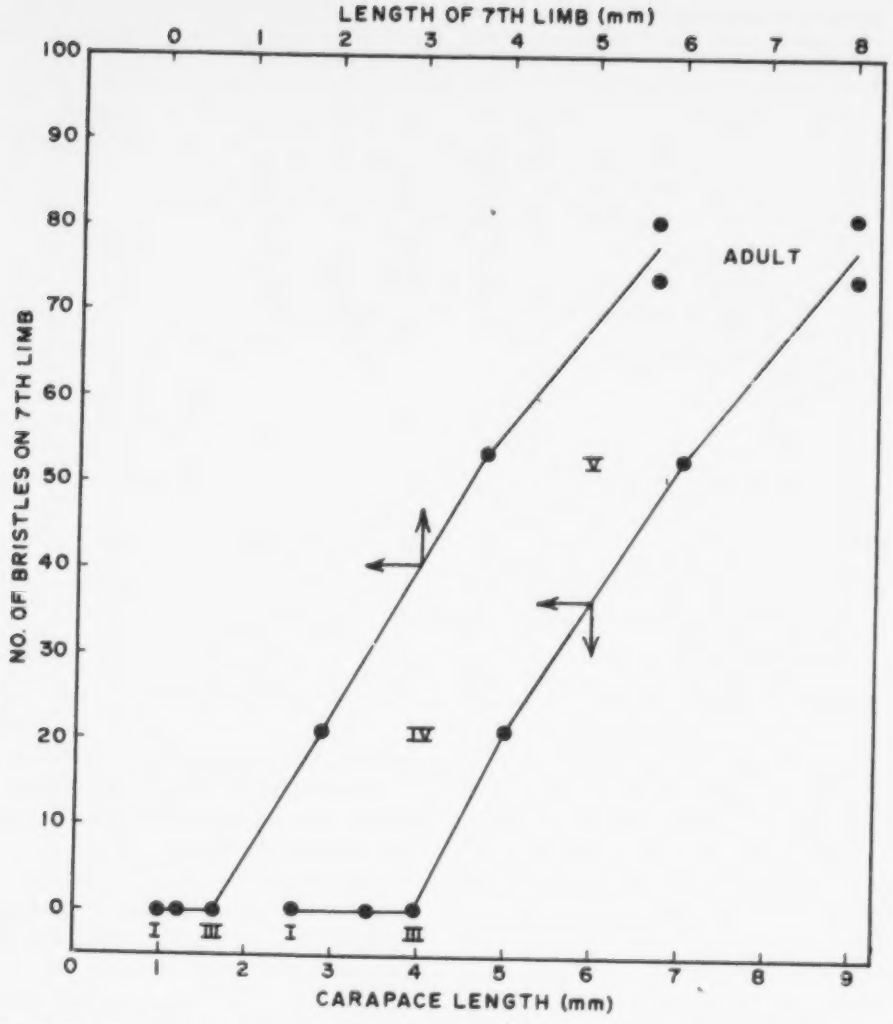



FIGURE 34.—Number of bristles on 7th limb as a function of length of limb and carapace length of *Azygocypridina imperialis* (Stebbing).

succeeding instars. The number of bells on bristles of the 7th limb increases in succeeding instars, and adults differ from preceding instars in having no bristles with only 1 bell, but only a few specimens were studied and this may not hold for all specimens (Figure 31). The furca of instar I is different than that on succeeding instars in having many spine-like claws fused to the lamella; later stages have all claws separated from the lamella by a suture.

ECDYSIS AND GROWTH.—An instar V female (USNM 193341) had within the appendages clearly visible adult appendages. All bristles of the 7th limb had within them a bristle of the adult. Individual bristles of the adult 7th limb contained 1–4 more bells than the bristles of instar V in which they were contained (Figure 32). Additional bristles were observed on the 7th limbs of the adult that did not extend into bristles of instar V. Unlike marginal bristles of the 7th limb, the comb teeth of the adult were larger than the comb teeth of instar V and did not lie within the comb teeth of the latter in the molting limb (Figure 30*r*). On the furca, claws of the adult were clearly visible within those of instar V but no additional adult claws were observed, perhaps indicating that for this specimen the adult would have had the same number of claws as its 5th instar (Figure 30*s,t*).

GROWTH.—The allometric increase in length of the 7th limb in relation to shell length is shown graphically in Figure 33. The number of bristles of the 7th limb is both a function of shell length and limb length (Figure 34). The number of furcal claws of the adult are about twice those of instars I and II, but variability in numbers of claws at each stage is sufficient that adjacent instars may have an overlap in numbers of claws (Figure 33).

## PHILOMEDIDAE Müller, 1906

The Philomedidae comprise the 2 subfamilies Philomedinae and Pseudophilomedinae; both are represented in the collections.

## PHILOMEDINAE Müller, 1906

The Philomedinae are represented in the collections by 2 species of the genus *Philomedes* Liljeborg, 1853. A species of the genus *Euphilomedes* Kornicker, 1967 (*E. sinister sinister* Kornicker, 1974) at unspecified depth, and a species of *Scleroconcha* (*S. folinii* (Brady, 1871)) at a depth of 64–128 m, have been reported previously from the Bay of Biscay (Brady and Norman, 1896:657, 664), but were not in the present collections.

### *Philomedes* Liljeborg, 1853

*Philomedes* Liljeborg, 1853:175.

TYPE SPECIES.—*Philomedes longicornis* Liljeborg, 1853:176 (= *Cypridina Brenda*, 1850).

DISTRIBUTION.—Widespread; previously recorded in the Atlantic Ocean ranging from the Arctic to Antarctic at depths of intertidal to 3382 m. Specimens reported upon herein were collected at depths of 1031–3480 m, slightly increasing the known depth range of the genus.

COMPOSITION.—Two species in the collections have been referred to *Philomedes: P. lilljeborgii* (Sars, 1865) and *P. pentathrix*, new species. Brady (1871:292) identified specimens collected at depths of 1435 m and 2333 m in the Bay of Biscay as *Philomedes brenda* (Baird, 1850) but these were referred to Cypridininae genus and species indeterminate by Kornicker (1982:5). Brady (1887:198) described *Philomedes biscayensis* (Brady, 1887) at a depth of 460 m in the Bay of Biscay but the species was referred to *Cypridinidarum genera dubia et species dubiae* by Müller (1912:50), a decision with which I concur. *Philomedes macandrei* (Baird, 1848) was reported from the Bay of Biscay at undisclosed depth by Brady and Norman (1896:662), but was not in the samples reported upon herein.

### *Philomedes lilljeborgii* (Sars, 1865)

FIGURES 35–38

*Bradycinetus Lilljeborgii* Sars, 1866[1865]:112.
*Philomedes bonneti* Kornicker and Carsion, 1977:6, figs. 6–10, pls. 1–4.—Kornicker, 1982:23 [key].
*Philomedes* species B.—Kornicker, 1985:410–412.
*Philomedes lilljeborgii*.—Kornicker, 1987:877, figs 1, 2a–d [see for complete synonymy].

HOLOTYPE.—Lost (Skogsberg, 1920:409).

TYPE LOCALITY.—Near Drobak, Christiania Fjord, Norway, 110–183 m.

MATERIAL.—BIOGAS I, R.V. *La Perle*, sta Hors-Zone: sample DS-04, USNM 193250, 8 specimens. BIOGAS II, R.V. *Jean Charcot*, sta Hors-Zone: sample DS-34, 4 specimens and 1 adult female (USNM 157979) + 19 specimens. BIOGAS III, R.V. *Jean Charcot*, sta 1: sample DS-36, 1 ovigerous female (USNM 193249) + 1 adult male (USNM 193247) + 2 adult females (USNM 193248) + 78 specimens.

DISTRIBUTION.—West of Bay of Biscay, 1031–2147; off Mauritania, 1120 m; west coasts of Norway and Sweden, 50–914 m.

SUPPLEMENTARY DESCRIPTION OF ADULT FEMALE (Figures 35, 36).—Carapace with prominent rostrum, broad incisur and small but distinct caudal process (Figure 35a); inferior corner of rostrum with minute protuberance.

*Ornamentation:* Carapace smooth with bristles along anterior, ventral, and posterior margins, and sparsely distributed on lateral surface.

*Infold:* Broad along anterior, anteroventral, and posteroventral margins and narrower ventrally and posteriorly; infold on rostrum with 25–30 bristles (bristles spinous and divided except for 3 or 4 bare and shorter bristles along ventral edge of incisur); 1 minute bristle on infold posterior to incisur; anteroventral infold with about 14 striae and 20 or 21 short spinous bristles along list; no bristles along middle part of ventral list; posteroventral and posterior infold with numerous small bristles along raised list (about 57 bristles in groups of 1–4 bristles); infold of caudal process with narrow flap forming pocket (pocket open ventrally) parallel to ventral margin of valve (Figure 35b); ventral margin of flap with 6 or 7 short bare bristles; 1 short bare bristle present on infold about midway between anterior end of flap and ventral margin of valve; 1 or no short bare bristle present between flap and list.

*Selvage:* Lamellar prolongation with marginal fringe present along anterior, ventral, and posterior margins of valve; prolongation segmented along rostrum and incisur, and divided at inner end of incisur; long filaments with bases on lateral side near longitudinal suture present on selvage below incisur.

*Size:* USNM 157979, length 2.10 mm, height 1.46 mm; USNM 193249, length 2.17 mm, height 1.46 mm; USNM 193248A, length 2.11 mm, height 1.43 mm; USNM 193248B length 2.12 mm, height 1.42 mm; USNM 193246, length 2.07 mm, height 1.41 mm.

*First Antenna* (Figure 35*c*): 2nd joint with lateral spines forming row in distal anterior corner.

*Second Antenna:* Protopodite bare. Endopodite (Figure 35*d*): 1st joint with 6 bare bristles (5 proximal, 1 distal); 2nd joint with 3 or 4 ventral bristles and 1 recurved dorsal bristle near tip (Table 8). Exopodite: 1st joint with minute, straight, medial bristle on distal margin; bristle of 2nd joint with few, small, proximal, ventral spines; bristles of joints 3–5 bare; bristles of joints 2–5 about half length of bristles of joints 6–8 as well as long bristles of 9th joint; bristles of joints 6–8 long, with natatory hairs; 9th joint with 7 bristles (4 long with natatory hairs; 2 short with natatory hairs, 1 very short with

FIGURE 35.—*Philomedes lilljeborgii* (Sars), adult female, USNM 157979: *a*, complete specimen from left side, length 2.10 mm; *b*, caudal process of left valve from inside; *c*, left 1st antenna, medial view; *d*, endopodite of left 2nd antenna, medial view; *e*, left mandible, medial view; *f*, hairs and spines on basale, 1st endopodial joint, and exopodite of left mandible (only bristles of exopodite shown), medial view.

TABLE 8.—*Philomedes lilljeborgii*: Variability in numbers of bristles of the ventral margin of the 2nd endopodial joint of the 2nd antenna, the dorsal margin of the mandibular basale, the end joint of the 6th limb, and the 7th limb (na = not applicable; dash = no data).

| Specimen | Ventral margin 2nd endopodial joint, 2nd antenna | | Dorsal margin mandibular basale | | End joint 6th limb | | 7th limbs |
|---|---|---|---|---|---|---|---|
| | left | right | left | right | left | right | |
| USNM 157979, female | 4 | 3 | 6 | 6 | 23 | 26 | 9, 10 |
| USNM 193249, female | 3 | 3 | 5 | 6 | 26 | 27 | 9, 11 |
| USNM 193248, female | 3 | 4 | 6 | 6 | - | - | 9, 10 |
| USNM 193247, male | na | na | 6 | 5 | 18 | 17 | 11, 12 |

small marginal spines); long bristles broken on specimen with larvae; joints 2–8 with spines forming rows along distal margins; some joints with basal spines but obscure on specimen examined.

*Mandible* (Figure 35*e,f*): Coxale with spinous and bifurcate endite with small ringed bristle near base. In addition to 2 subterminal bristles, dorsal margin of basale with 3 or 4 distal bristles (Table 8). Proximal group on dorsal margin of 1st endopodial joint with 5 bristles. Medial surfaces of basale and 1st and 2nd endopodial joints with spines forming rows.

*Maxilla:* Coxale with stout hirsute dorsal bristle. Distal margin of basal with 4 bristles (2 closely spaced dorsal, 1 ventral, 1 medial). 1st endopodial joint with 1 alpha-bristle (with long proximal and short distal spines) and 4 or 5 beta-bristles (most with short marginal spines). Exopodite with short, bare bristle close to 2 terminal bristles bearing long marginal spines.

*Fifth Limb* (Figure 36*a–c,h,i*): 1st exopodial joint: anterior side with 2 bristles near midwidth (inner bristle with small spines along inner edge; outer bristle with few long spines near middle and minute spines along inner edge (Figure 36*a*), and 1 short spinous bristle with stout base near outer corner of joint; anterior surface of joint hirsute and with spines forming clusters near broad base of short outer bristles. Main tooth with 4 constituent teeth (distal tooth with 4 small teeth proximal to larger terminal tooth and with large bifurcate anterior tooth; tooth proximal to distal tooth with total of 11 small marginal teeth; next tooth smaller and with about 12 small marginal teeth; 4th tooth slender and with faint spine-like marginal teeth); spinous bristle proximal to 4th tooth (Figure 36*h,i*). 2nd exopodial joint: outer edge of large triangular tooth forming joint with small hirsute bristle; posterior side with stout c-bristle with distal marginal spines and 3 bristles forming row (middle of these stout and with distal spines; others short and either bare or with faint spines); inner curvature of triangular tooth with 2 teeth (proximal of these with 2 minute teeth, other with 3; Figure 36*b,i*). 3rd exopodial joint: inner lobe with 3 bristles (proximal bristle slender; middle bristle stout, pectinate, and with long proximal spines; distal bristle longer than middle bristle (but not as stout), pectinate and with long proximal spines); outer lobe small with 2 hirsute bristles. 4th and 5th joints fused, with total of 6 spinous bristles. Epipodial appendage with about 50 bristles.

*Sixth Limb* (2 specimens examined)(Figure 36*d*): Endite I with 2 short medial bristles with long proximal hairs and short distal spines and 1 long terminal bristle with wreaths of long spines; endite II with 1 short medial bristle with long proximal hairs and short distal spines and 3 long terminal bristles (2 with wreaths of long spines, 1 with long proximal and short distal spines); endite III with 1 proximal bristle with long proximal hairs and short distal spines and 8 spinous terminal bristles; endite IV with 1 medial bristle with long proximal hairs and 9 terminal spinous bristles. End joint with 23–27 spinous and hirsute bristles (Table 8); 4 short bristles with long proximal hairs and short distal spines in place of epipodite.

*Seventh Limb* (Figure 36*e*): Each limb with 9–11 bristles (5 or 6 terminal, 2 or 3 on each side, and 5 or 6 proximal, 2 or 3 on each side) (Table 8); each bristle with 4 or 5 bells (usually 5); hairs present on bristles proximal to bells. Terminus with comb of 14 teeth (each tooth with alar projection on each side and a rounded tip; middle tooth about same length as adjacent lateral teeth); side opposite comb with 10–12 elongate pegs forming 2 rows (5 to 7 pegs in each row).

*Furca* (Figure 36*f*): Each lamella with 10 claws decreasing in length along lamella; claw 1 of right lamella slightly anterior to that of left.

*Bellonci Organ* (Figure 36*g*): Elongate with or without faint suture at small restriction near middle; tip rounded.

*Eyes* (Figure 36*g*): Lateral eye minute, indistinct, with few small globules. Medial eye well developed with light amber pigment.

*Upper lip* (Figure 36*g*): Typical for genus.

*Anterior of Body* (Figure 36*g*): Process with rounded tip present between upper lip and medial eye.

*Posterior of Body* (Figure 36*f*): Posterior of body just dorsal to furca with hairs; posterodorsal corner of body bare.

*Y-Sclerite* (Figure 36*f*): Ventral branch closer to distal end of sclerite than to proximal end, forming right angle with dorsal branch.

*Eggs:* USNM 193249 with 19 and USNM 193248A with 17 well-developed eggs in marsupium.

SUPPLEMENTARY DESCRIPTION OF ADULT MALE (Figures

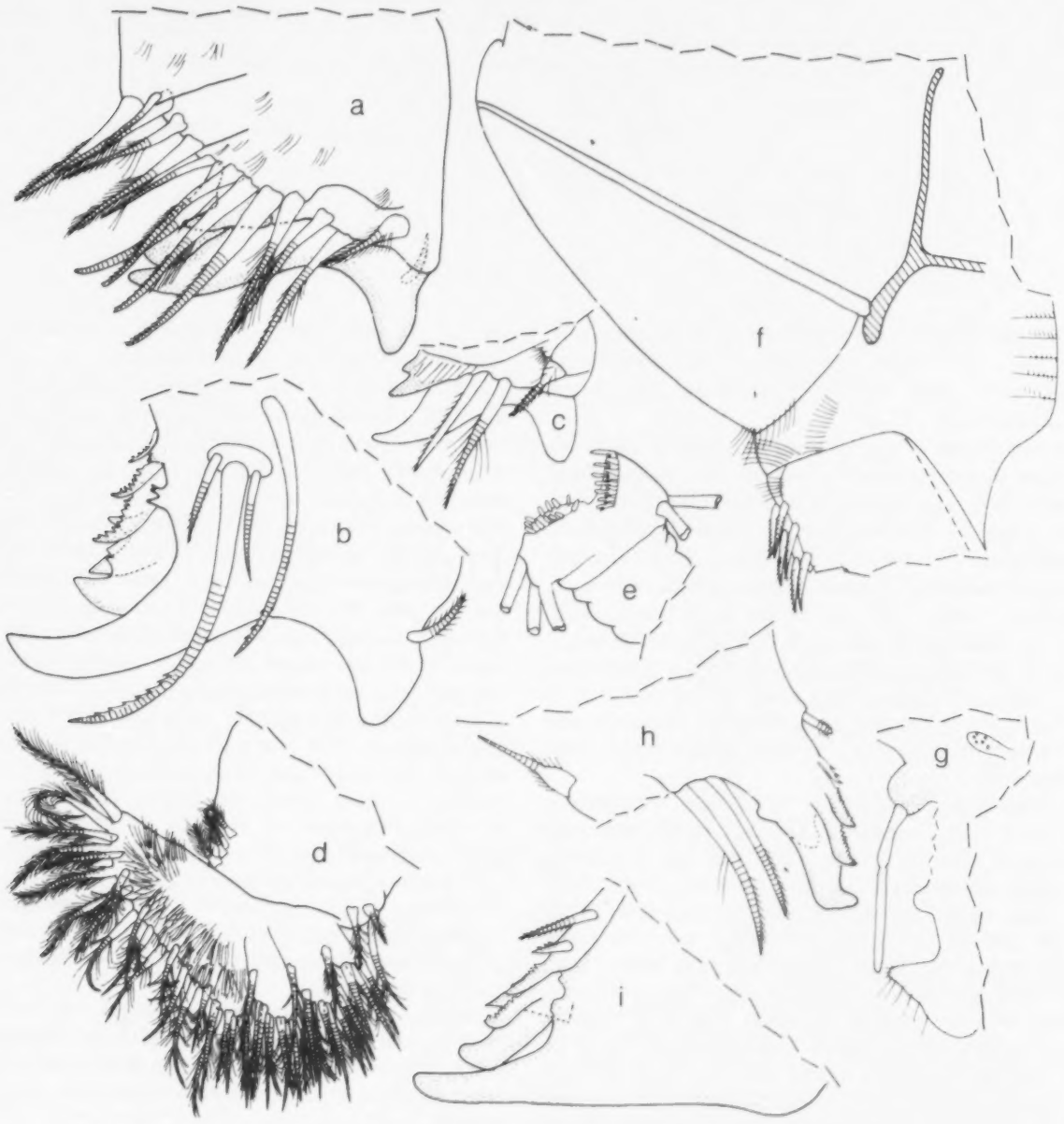



FIGURE 36.—*Philomedes lilljeborgii* (Sars), adult female, USNM 157979: *a*, left 5th limb, anterior view; *b*, right 5th limb, posterior view; *c*, left 5th limb, anterior view; *d*, left 6th limb, medial view; *e*, tip of 7th limb; *f*, posterior of body showing Y-sclerite (lined), girdle, and proximal 3 claws of each lamella of furca; *g*, anterior of body showing left lateral eye, medial eye and Bellonci organ, anterior process, and upper lip. Ovigerous female, USNM 193248A, length 2.11 mm: *h*, 1st exopodial joint of left 5th limb, posterior view; *i*, 1st and 2nd exopodial joints of right 5th limb, posterior view.

37, 38).—Carapace more elongate than that of female, with more open incisur and with rostrum tapering anteriorly (Figure 37*a*).

*Ornamentation:* Carapace smooth with long undivided bristles; most bristles with broad basal part and sparsely distributed over valve surface, and especially numerous along anterior and anteroventral margins and near posterior margin.

*Infold:* Infold of caudal process similar to that of female (Figure 38*b*). Infold elsewhere not examined in detail but, in general, similar to that of female.

FIGURE 37.—*Philomedes lilljeborgii* (Sars), adult male, USNM 193247: *a*, complete specimen from outside showing location of right lateral eye and central adductor muscle attachment scars (dashed ovals) and internal list of caudal process, length 2.21 mm; *b*, caudal process of left valve from inside; *c*, right 1st antenna, lateral view; *d*, endopodite of right 2nd antenna, medial view; *e*, maxilla; *f*, 5th limb (not all bristles shown on endites and 1st and 2nd exopodial joints).

*Size:* USNM 193247, length 2.21 mm, height 1.18 mm.

*First Antenna* (Figure 37*c*): 1st joint bare. 2nd joint spinous with 3 bristles (1 ventral, 1 dorsal, 1 lateral; ventral bristle almost reaching distal end of 5th joint, with wreaths of long spines near midlength; lateral bristle slender, about 1/2 length of ventral bristle, with short marginal spines; dorsal bristle slender, about 1/3 length of ventral bristle, with short marginal spines). 3rd joint short, with 1 long ventral bristle (with long spines near midlength and short spines distally) and 3 dorsal bristles (2 long with long spines near midlength; 1 very short with short marginal spines). 4th joint about twice length of 3rd, with 4 ventral bristles and without dorsal bristle (probably broken off). 5th joint small, wedged ventrally between 4th and 6th joint; sensory bristle with stout proximal part bearing abundant filaments and distal part with 5 shorter terminal filaments (1 terminal filament with base proximal to others). 6th joint slightly shorter than 4th joint, with slender medial bristle (about same length as joint) with long spines near midlength. 7th joint: a-bristle about same length as bristle of 6th joint, with short marinal spines; b-bristle stout, about twice length of a-bristle, with 3 proximal and 5 terminal filaments (including stem); c-bristle very long and with about 12 short filaments. 8th joint: bare d-bristle about 2 1/2 times length of a-bristle; e-bristle unusually long, about 3 1/2 times length of a-bristle; f-bristle very long (about twice length of stem), with about 13 short marginal filaments; g-bristle about same length as b-bristle, with 3 proximal and 4 terminal filaments (including stem).

*Second Antenna:* Protopodite bare. Endopodite 3-jointed (Figure 37*d*): 1st joint short, with 5 proximal and 1 distal bristle, all about same length; 2nd joint elongate, with 3 ventral bristles with short marginal spines (2 distal bristles separated from each other by space equal in length to diameter of base of bristle); 3rd joint reflexed, with proximal bristle about 1/3 length of joint and 2 small subterminal bristles; tip of joint with about 6 ridges; inner margin of joint undulate and sclerotized. Exopodite: 1st joint with few lateral spines forming distal rows and small straight medial bristle on distal margin; 2nd joint about 1/3 length of 1st, with bare bristle reaching to about 6th joint; 3rd joint about 1/3 longer than 2nd; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 6 bristles (4 long, 2 short), all with natatory hairs; joints 2–8 with spines forming rows along distal margins; joints 3–8 with small basal spine increasing slightly in length on distal joints; basal spine of 8th joint about 1/2 length of joint.

*Mandible* (Figure 38*a*): Coxale endite comprising small bifurcate process with small bristle near base; both branches pointed but dorsal branch shorter and with few marginal spines. Basale: dorsal margin with 3 or 4 (usually 4) slender spinous bristles in addition to terminal pair (Table 8); medial side spinous, with 5 bristles at proximal ventral corner (2 ringed, 3 unringed, all with short marginal spines) and 1 longer ringed bristle (with long proximal and short distal spines) closer to midlength of joint; lateral side near ventral margin with 4 bristles with long proximal and short distal hairs (proximal of 4 with base on ventral margin); ventral margin with 2 stout terminal bristles with wreaths of long spines. Exopodite reaching just past midlength of dorsal margin of 1st endopodial joint, hirsute distally and with pointed terminal process; proximal bristle just slightly longer than distal bristle (longest bristle on right limb of specimen examined bearing long spines at midlength). 1st endopodial joint with medial spines forming rows on ventral half, and with 5 stout, spinous, ventral bristles. 2nd endopodial joint with abundant medial spines forming rows; ventral margin with spines and 6 distal bristles (with short spines) forming 2 groups with 3 bristles in each group; dorsal margin with bristles forming 3 groups at joint midlength (proximal group with 2 bristles, middle group with 1 bristle, distal group with 5 or 6 bristles. End joint with 3 claws (all with ventral spines; dorsal claw about half length of longest claw) and 4 or 5 ringed bristles (3 or 4 ventral, 1 dorsal).

*Maxilla:* Reduced, with 3 endites bearing slender hirsute bristles. Precoxale and coxale with fringe of dorsal hairs; coxale with stout hirsute dorsal bristle. Basale with 4 distal bristles: 2 dorsal, 1 medial, 1 ventral, all with long marginal hairs. Exopodite with 2 long terminal bristles and 1 short subterminal bristle, all with long marginal hairs. 1st endopodial joint with long hairs forming rows (absent along dorsal margin), 1 slender alpha-bristle with long marginal hairs, and 4 slender beta-bristles with long marginal hairs. End joint with about 11 weakly developed bristles.

*Fifth Limb* (Figure 37*f*): Limb reduced; epipodite with about 46 bristles; 3 endites with slender weakly developed bristles. 1st and 2nd exopodial joints obscure but each with 1 or 2 broad flat unringed bristles with marginal hairs. Inner lobe of 3rd joint with 3 slender ringed bristles; outer lobe hirsute with 2 stout, long, hirsute bristles. Fused 4th and 5th joints hirsute with 6 slender ringed bristles, some with marginal hairs.

*Sixth Limb* (Figure 38*b*): 1–3 ringed bristles (with hairs on proximal half) in place of epipodite. Endite I with 2 medial bristles (with long proximal hairs) and single terminal bristle; endite II with single medial bristle and 3 terminal bristles, all with long proximal hairs; endite III with single medial bristle (with long proximal hairs) and 7 or 8 terminal bristles (most with long hairs except near tip); endite IV with a single medial bristle (with long proximal hairs) and 8 or 9 terminal bristles (most with long proximal hairs). End joint with 17 or 18 bristles (posterior 2 hirsute and most others also hirsute except near tip (Table 8). Limb hirsute.

*Seventh Limb* (Figure 38*c*): Each limb with 11 or 12 bristles (5 or 6) terminal, 2 or 3 on each side, and 5 or 6 proximal, 3 on each side (Table 8); bristles with few hairs proximal to bells. Terminus with comb of 10–12 teeth; each tooth with alar projections on each side and rounded tip; middle tooth only slightly longer than adjacent teeth; side opposite comb with 7 or 8 elongate pegs forming 2 rows with 3–5 pegs in each row.

*Furca:* Each lamella with 9 claws decreasing in length

FIGURE 38.—*Philomedes lilljeborgii* (Sars), adult male, USNM 199247: *a*, left mandible, medial view; *b*, left 6th limb, medial view; *c*, tip of 7th limb; *d*, medial eye; *e*, Bellonci organ; *f*, lateral eye (not all ommatidia shown).

along lamella; claw 1 of right lamella slightly anterior to that of left; claws 1–6 with long spines forming medial row near base; claws 7–9 without medial spines; anterior distal corner of each lamella near base of claw 1 with few spines; additional spines forming short medial rows just within anterior edge of right lamella.

*Bellonci Organ* (Figure 38*e*): Elongate with suture at narrow part near midlength; tip rounded.

*Eyes* (Figure 38*d,f*): Lateral eye amber, well developed, with about 27 ommatidia (12–16 of these larger than others and forming rows, each with 4 or 5 divided ommatidia). Medial eye amber, about same size as lateral eye, bare.

*Upper Lip, Anterior and Posterior of Body, Y-Sclerite:* Similar to those of female.

*Genitalia:* With elongate copulatory organ on each side of body, each with 2 or 3 lobes bearing few small bristles.

VARIABILITY (Table 8).—Variability in numbers of bristles on the ventral margin of the 2nd endopodial joint of the 2nd antenna, the dorsal margin of the mandibular basale, the end joint of the 6th limb, and the 7th limb are given in Table 8.

REMARKS.—The range of the length of the carapaces of adult females from Norway and Sweden was given by Skogsberg (1920:404) as 2.15–2.6 mm, whereas, the length of the single female from off Mauritania reported by Kornicker and Caraion (1977:10) was 1.99 mm. The range of carapace length of five specimens from west of the the Bay of Biscay is 2.10–2.17 mm. This suggests that carapace length decreases southward.

### *Philomedes pentathrix*, new species

FIGURES 39–42

*Philomedes* species A.—Kornicker, 1985:410–412 [part, except for specimens from sample DS-36 referred to *P. lilljeborgii*, herein].

ETYMOLOGY.—The species name is from the Greek *penta* (five) and *thrix* (hair.)

HOLOTYPE.—Adult female in alcohol, MNHN Os 158, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS I, Hors-Zone, R.V. *Jean Charcot*, West of Bay of Biscay, 47°30′12″N, 8°16′W, 2130 m, Sanders dredge, sample DS-09, August 1972.

PARATYPES.—BIOGAS I, R.V. *Perle*, sta Hors-Zone: sample DS-05, 1 juvenile; sample DS-09, 1 early instar; sample DS-14, 1 specimen. Sta 1: sample DS-11, 1 juvenile; sample DS-12, 2 juveniles; sample DS-13, 1 ovigerous female (USNM 157976) + 30 specimens. BIOGAS II, R.V. *Jean Charcot*, sta Hors-Zone: sample DS-33, 1 juvenile. Sta 1: sample DS-32, 1 adult male. Sta 2: sample DS-31, 1 adult male (USNM 193190) + 4 adult males + 12 specimens. BIOGAS III, R.V. *Jean Charcot*, sta 1: sample DS-35, 14 specimens; sample DS-38, 16 specimens. BIOGAS IV, R.V. *Jean Charcot*, sta 1: sample DS-61, 44 specimens; sample DS-62, 11 specimens; sample DS-63, 2 specimens; sample KR-37, 1 juvenile. Sta 2: sample DS-59, 1 ovigerous female (USNM 158591) + 1 juvenile. Sta 6: sample DS-52, 1 male. BIOGAS V, R.V. *Jean Charcot*, sta 2: sample DS-66: 2 specimens. BIOGAS VI, R.V. *Jean Charcot*, sta 1: sample DS-71, 1 specimen; sample CP-08, 3 specimens; sample CP-08a, 1 specimen; sample CP-09, 51 specimens; sample CP-09a, 64 specimens. Sta 2: sample DS-74, 1 specimen. Sta 6: sample DS-87, 1 specimen. BIOGAS VIII, R.V. *Le Noroit*, sta 1: sample K1 juvenile, sample KG-145, 1 instar II; sample KG-148, 1 adult female (USNM 193007) + 3 juveniles; sample KG-149, 1 juvenile; sample KG-156, 2 juveniles; sample KG-157, 1 adult female (USNM 193006) + 3 juveniles; sample KG-158, 1 ovigerous female (USNM 193005). BIOGAS XI, R.V. *Jean Charcot*, sta 1: sample CP-37: 3 specimens. Paratypes in Paris: MNHN Os 159-193.

FIGURE 39.—*Philomedes pentathrix*, new species, ovigerous female, paratype, USNM 158591, complete specimen, length 2.19 mm.

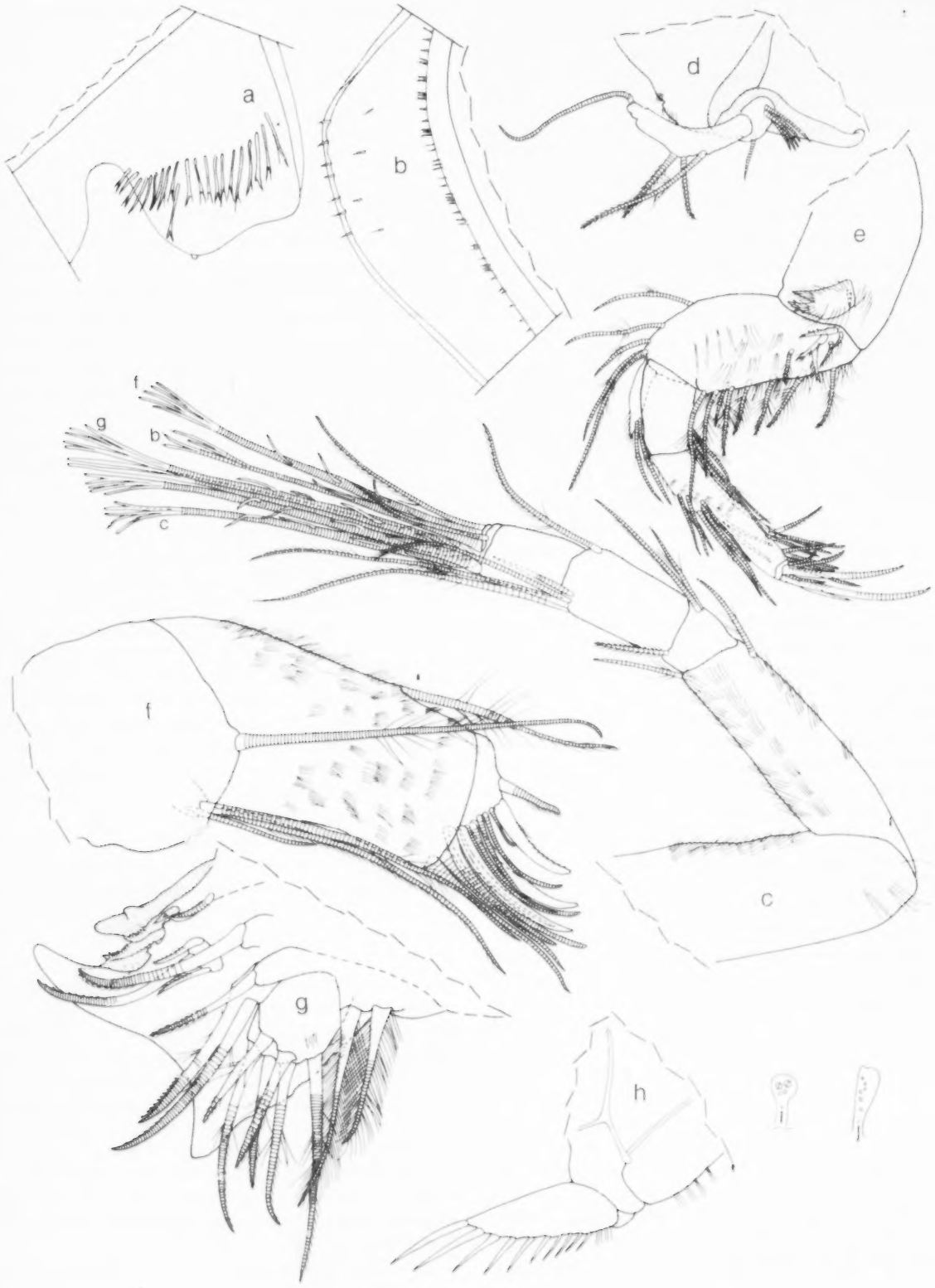
ADDITIONAL MATERIAL.—BIOGAS IX, R.V. *Capricorne*, sta 2: sample KG-180, 1 instar (identification questionable).

DISTRIBUTION.—In and west of Bay of Biscay, 1560-3480 m.

DESCRIPTION OF ADULT FEMALE (Figures 39–41).—Carapace with prominent rostrum, broad incisur and truncate posterior (Figures 39, 40*a,b*); inferior rounded corner of rostrum with minute protuberance (not shown on Figure 39, but on Figure 40*a*).

*Ornamentation:* Carapace smooth with bristles along anterior, ventral, and posterior margin, and sparsely distributed on lateral surface.

FIGURE 40.—*Philomedes pentathrix*, new species, ovigerous female, paratype, USNM 193005, length 2.21 mm: *a*, rostrum from inside showing bristles of infold; *b*, caudal process from inside; *c*, right 1st antenna (lateral bristle of 2nd joint not shown), medial view; *d*, distal part of protopodite and endopodite of left 2nd antenna, medial view; *e*, right mandible, medial view; *f*, basale and endopodite of maxilla; *g*, right 5th limb (endite not shown), posterior view. Adult female, paratype, USNM 193007, length 2.22 mm: *h*, posterior of body showing left lamella of furca, left Y-sclerite and part of girdle, and hairs on posterior margin; *i*, lateral eye; *j*, ovigerous female, paratype, USNM 158591, length 2.19 mm, left lateral eye.


a
b
d
e
f
g
b
c
f
c
g
h
i

*Infold* (Figure 40*a*,*b*): Broad along anterior and posterior and narrower ventrally; infold on rostrum with 21–23 bristles (mostly spinous and divided); 1 minute bristle on infold posterior to incisur; anteroventral part of infold with about 15 striae and 14 or 15 bristles along list; no bristles along middle part of ventral infold; posteroventral and posterior infold with numerous small bristles along raised list (about 69 bristles in groups of 1–4 bristles); 4 or 5 small bristles between list and posteroventral edge of caudal process; posteroventral edge of caudal process with 7 short pointed bristles.

*Selvage:* Lamellar prolongation with marginal fringe present along anterior, ventral and posterior margins; prolongation segmented along rostrum and incisur, and divided at inner end of incisur; long filaments with bases on lateral side of prolongation present below incisur.

*Size:* USNM 157976, length 2.19 mm, height 1.50 mm; USNM 158591, length 2.19 mm, height 1.51 mm; USNM 193005, length 2.21 mm, height 1.51 mm; USNM 193006, length 2.21 mm, height 1.51 mm; USNM 193007, length 2.22 mm, height 1.49 mm.

*First Antenna* (Figure 40*c*): 1st joint spinous. 2nd joint spinous, with 2 spinous bristles (1 dorsal, 1 lateral, near ventral margin on illustrated limb, but usually near midheight). 3rd joint short with 3 spinous bristles (1 ventral, 2 dorsal). 4th joint with 5 bristles (4 ventral, 1 dorsal). Sensory bristle of 5th joint with 5 short marginal filaments and 5 terminal filaments; lateral surface of joint with spines forming rows. Bristle of short 6th joint with long proximal and short distal spines. 7th joint: a-bristle about 1/3 longer than bristle of 6th joint, spinous; b-bristle about twice length of a-bristle, with 1 proximal and 4 terminal filaments; c-bristle about same length as sensory bristle of 5th joint, with 4 proximal and 5 terminal filaments. 8th joint: d- and e-bristles slightly longer than c-bristle, bare with blunt tips; f-bristle about same length as c-bristle, with 4 proximal and 5 terminal filaments; g-bristle longer than c-bristle, with 3 proximal and 5 terminal filaments. All filaments with minute terminal spine.

*Second Antenna* (Figure 40*d*): Protopodite with long distal hairs along dorsal margin, shorter distal spines along ventral margin, and short spines forming rows on medial surface near ventral and dorsal margins. Endopodite 2-jointed: 1st joint short with 6 bristles (5 proximal, 1 distal); 2nd joint elongate, with 3 or 4 spinous ventral bristles and long terminal bristle. Exopodite: 1st joint with minute, straight, medial, terminal bristle with tubular tip; bristles of joints 2–5 relatively short but longer than combined lengths of joints 2–9, with slender ventral spines, without natatory hairs; bristles of joints 6–8 long, with natatory hairs; 9th joint with 7 bristles (4 long with natatory hairs, 1 medium and 2 short with short marginal hairs); joints 2–8 with spines forming row along distal margin; joints 3–8 with small basal spines; basal spine of 8th joint about 3/4 length of 9th joint; 9th joint with short lateral spine. Bristles of joints 6–8 and 4 long bristles of joint 9 broken on some specimens. Distribution of bristles on the 2nd endopodial joint of the 2nd antenna of 5 specimens is tabulated below.

| *USNM number* | *Right limb* | *Left limb* |
|---|---|---|
| 157976 | 5 | 5 |
| 158591 | 5 | 4 |
| 193005 | 5 | 4 |
| 193006 | 4 | 4 |
| 193007 | 4 | 5 |

*Mandible* (Figure 40*e*): Coxale endite bifurcate, spinous, with minute bristle near base. Basale: medial surface spinous, with 6 proximal bristles (3 unringed, pectinate; 3 ringed, spinous) near ventral margin; lateral surface with 3 or 4 spinous bristles with bases on or near ventral margin; ventral margin hirsute, with 1 proximal and 3 distal spinous bristles; dorsal margin with 5 distal spinous bristles. Exopodite more than 3/4 length of 1st endopodial joint, hirsute distally, with 2 distal bristles (proximal of these only slightly longer than other). 1st endopodial joint with 4 ventral bristles and terminal dorsal spines forming row. 2nd endopodial joint: ventral margin with few spines and 6 bristles in 2 groups (3 in each group); dorsal margin with proximal spines and 9 bristles forming 2 groups near midlength of joint (3 bristles in proximal group, 6 in distal); medial surface with spines forming rows. End joint with 4 bristles and 3 claws with proximal ventral spines.

*Maxilla* (Figure 40*f*): Coxale with fringe of dorsal hairs and hirsute dorsal bristle; endite I broad, with 10 spinous and pectinate bristles; endite II narrow, with 6 spinous and pectinate bristles; endite III narrow, with 1 proximal bristle and 7 or 8 spinous and pectinate bristles (teeth on 2 of the pectinate bristles very large). Basale with 4 long terminal bristles (1 ventral, 1 medial, 2 dorsal); only medial bristle shown on illustrated limb). Exopodite small, with 3 bristles. 1st endopodial joint spinous, with 1 spinous alpha-bristle and 3 or 4 beta-bristles. End joint with 4 slender a-bristles with short marginal spines, 3 stout claws, and 5 bristles.

*Fifth Limb* (Figure 40*g*): Endite I with 5 bristles; endites II and III each with about 9 bristles. 1st exopodial joint: main tooth comprising 4 constituent teeth (proximal tooth small cone-like with 1 or 2 minute marginal teeth; next 2 teeth with marginal teeth; distal tooth large with triangular anterior part bearing 1 or 2 marginal teeth); spinous bristle proximal to cone-like tooth; anterior side with paired spinous bristles at midwidth, and short spinous bristle on process near outer edge. 2nd endopodial joint: inner curvature of large, flat, triangular tooth with 2 small teeth with digitate terminal edge; posterior side with 3 bristles forming group (comprising long middle bristle and smaller bristle on either side, all with small marginal teeth or spines), and 1 long stout proximal bristle with distal teeth along outer edge; anterior side with small spinous bristle at outer distal corner of large flat tooth. Outer lobe of 3rd exopodial joint with 2 hirsute bristles, inner lobe with 3 spinous bristles, 4th and 5th exopodial joints fused, hirsute, with total of 6 spinous brisles.

*Sixth Limb* (Figure 41*a*): 3 hirsute bristles in place of

FIGURE 41.—*Philomedes pentathrix*, new species, ovigerous female, paratype, USNM 193005: *a*, left 6th limb, lateral view; *b*, 7th limb; *c*, anterior of body showing medial eye and Bellonci organ, anterior process, and upper lip.

epipodite. Endite I with 2 spinous bristles; endite II with 3 or 4 spinous bristles; endite III and IV each with 1 medial spinous bristle and 8 or 9 terminal spinous bristles. End joint with 23–25 spinous and hirsute bristles. Endites and end joint with spines and hairs forming rows.

*Seventh Limb* (Figure 41*b*): Each limb with 21 bristles with marginal spines and 5–8 bells. Terminal bristles comprising 3 on peg side and 2 on comb side. Proximal bristles with 9 on peg side and 7 on comb side. Terminus with 2 pegs and comb of 13 flanged teeth with minute proximal tooth on each side; comb teeth increasing in length toward middle of comb.

*Furca* (Figure 40*h*): Each lamella with 10 claws; claws 1–5 primary, claws 6–10 secondary, but distinction not well defined on some lamellae; teeth present along posterior margins of claws; medial tooth distal to midlength of claw 1 larger than others; teeth of claws 1–5 triangular tooth-like, teeth of claws 6–10 slender, spine-like; hairs present at base of claws and following claws; few distal hairs along anterior edge of right lamella; claw 1 of right lamella slightly anterior to that of left lamella.

*Bellonci Organ* (Figure 41*c*): Elongate, with suture near midlength and rounded tip.

*Eyes:* Lateral eye minute, indistinct, with minute amber globules (ommatidia?) (Figure 40*i,j*), eye not observed on some specimens. Medial eye well developed, with light amber pigment (Figure 41*c*).

*Upper Lip* (Figure 41*c*): Hirsute, with few glandular processes at anterior tip.

*Anterior of Body* (Figure 41*c*): Cone-like projection with small process at tip present between upper lip and medial eye.

*Posterior of Body* (Figure 40*h*): Posterior margin dorsal to furca with long hairs; short spines on posterodorsal bulge just above dorsal end of girdle.

Y-*Sclerite* (Figure 42): With ventral branch near midlength.

*Eggs:* USNM 158591, 193005 with 2 eggs; USNM 157976 with 7 eggs.

DESCRIPTION OF ADULT MALE (Figure 42): Carapace more elongate than that of adult female, with shallower incisur, and with concavity between posterior margin of valve and dorsal margin of caudal process (Figure 42*a*).

*Infold:* Not examined in detail but in general similar to that of female.

*Selvage:* Similar to that of female.

*Size:* Five specimens from BIOGAS II, sample DS-31: USNM 193190, length 2.68 mm, height 1.45 mm; length 2.73 mm, height 1.40 mm; length 2.73 mm, height, 1.38 mm; length 2.61 mm, length 1.44 mm; length 2.62 mm, length 1.34 mm.

*First Antenna* (Figure 42*b*): 1st joint bare, 2nd joint spinous, with 2 spinous bristles (1 dorsal, 1 lateral). 3rd joint short, spinous, with 3 spinous bristles (1 ventral, 2 dorsal), 4th joint with 5 bristles (4 ventral, 1 dorsal), 5th joint triangular, wedged ventrally between 4th and 6th joints; sensory bristle with stout, elongate, proximal part bearing abundant thin filaments, and bristle-like distal part about same length as stout proximal part, with 1 proximal and 5 terminal filaments. 6th joint long, with spinous medial bristle about same length as joint. 7th joint: a-bristle slightly shorter than bristle of 6th joint; b-bristle reaching past distal end of sensory bristle of 5th joint, with marginal filaments (tip broken off both limbs of specimen examined); c-bristle long, stout, with numerous filaments, broken. 8th joint: d- and e-bristles reaching well past distal end of sensory bristle of 5th joint, bare with blunt tips; f-bristle long, stout, with numerous filaments (broken on specimen examined); g-bristle broken on both limbs of specimen examined.

*Second Antenna* (Figure 42*c*): Protopodite bare. Endopodite 3-jointed: 1st joint with 6 bristles (5 proximal, 1 distal); 2nd joint elongate, with 3 short, spinous, ventral bristles; 3rd joint elongate, reflexed on 2nd, with slender proximal bristle, 2 small subterminal bristles, and tip with 6 ridges. Exopodite: 1st joint elongate, with distal spines along ventral margin and minute medial bristle on distal margin; 2nd joint about 1/3 length of 1st, with terminal bristle reaching 6th joint, with 6 or 7 small ventral spines at midlength, no hairs; 3rd joint about twice length of 2nd; bristles of joints 3–8 long, with natatory hairs, no spines; 9th joint with 6 bristles (4 long, 2 short, all with natatory hairs); joints 2–8 with minute spines forming row along distal margins; joints 4–7 with small basal spine.

*Mandible* (Figure 42*d*): Coxale endite represented by small process terminating in 2 long spines. Basale: medial surface spinous, 5 bristles (3 unringed, 2 ringed) in proximal ventral corner, and 1 spinous bristle proximal to midlength of joint; lateral surface with 3 spinous lateral bristles near ventral margin; ventral margin with 1 proximal and 3 distal spinous bristles; dorsal margin with 5 distal spinous bristles. Exopodite reaching midlength of dorsal margin of 1st endopodial joint, hirsute distally, with 2 terminal bristles (outer same length or 2/3 length of inner). 1st endopodial joint with medial spines, 5 ventral bristles, and terminal dorsal spines forming row. 2nd endopodial joint: medial surface and dorsal and ventral margins with long spines forming rows; ventral margin with 6 bristles forming 2 groups (3 bristles in each group); dorsal margin with 9 bristles near midlength. End joint with 4 bristles and 2 claws bearing proximal ventral spines.

*Maxilla:* Limb reduced. Coxale with fringe of dorsal hairs and hirsute dorsal bristle; endites I–III with weakly ringed bristles. Basale with 2 dorsal, 1 ventral, and 1 medial bristle on distal margin. Exopodite with 3 ringed hirsute bristles (2 long, 1 short). 1st endopodial joint with 1 spinous alpha-bristle and 3 beta-bristles. End joint with weakly developed claws and bristles.

*Fifth Limb* (Figure 42*e–g*): Endite I with 4 bristles; endite II with 7 bristles; endite III with about 7 bristles (3 unringed, broad). 1st endopodial joint with 4 unringed bristles (1 of these long, broad), and several ringed bristles. 2nd exopodial joint with 1 long, broad, unringed bristle with long marginal hairs, and several ringed bristles. 3rd exopodial joint with 2 stout

FIGURE 42.—*Philomedes pentathrix*, adult male, paratype, USNM 193190: *a*, complete specimen from left side showing location of lateral eye (dashed oval) and central adductor muscle attachment scars (lower oval), length 2.68 mm; *b*, left 1st antenna (lateral bristle of 2nd joint not shown), medial view; *c*, endopodite of right 2nd antenna, medial view; *d*, left mandible, medial view; *e*, 5th limb; *f*, 5th limb, endite III and 1st exopodial joint; *g*, 5th limb, 2nd exopodial joint; *h*, left 6th limb, medial view; *i*, 7th limb; *j*, posterior of body showing right lamella of furca, Y-sclerite and part of girdle, and hairs on posterior margin; *k*, anterior of body showing location of left lateral eye (oval), medial eye and Bellonci organ, broad anterior process, and upper lip.

hirsute bristles on outer lobe and 2 slender bristles on inner lobe. 4th and 5th exopodial joints fused, hirsute, with 5 slender ringed bristles. Epipodite with 53 bristles.

*Sixth Limb* (Figure 42*h*): Three or 4 hirsute bristles in place of epipodite. Endite I with 3 bristles; endite II with 1 medial and 2 terminal bristles; endite III with 1 medial and 8 terminal bristles; endite IV narrower than endite III, with 1 medial and 6–8 terminal bristles. End joint with 19 spinous and hirsute bristles. Endites and end joint with spines and hairs forming rows.

*Seventh Limb* (Figure 42*i*): Each limb with 14 or 15 bristles with 4–7 bells, no marginal spines. Terminal bristles comprising 3 on peg side, 2 on comb side. Proximal bristles with 5 or 6 on peg side and 4 on comb side. Terminus with 2 pegs and comb of about 11 teeth; comb teeth increasing in length towards middle of comb.

*Furca* (Figure 42*j*): Each lamella with 9 claws decreasing in length posteriorly, but claws 6–9 much smaller than claw 5. Claw 1 without large medial teeth as on claw of female. Teeth of claws 1–5 slender, tooth-like, teeth of claws 6–9 spine-like. Hairs present at bases of claws and following claws; claw 1 of right lamella anterior to claw 1 of left lamella; few distal hairs along anterior edge of right lamella.

*Bellonci Organ* (Figure 42*k*): Elongate with suture near midlength and rounded tip.

*Eyes* (Figure 42*k*): Lateral eye well developed, with about 20 ommatidia and black pigment. Maximum length of medial eye about same as maximum diameter of lateral eye, with brown pigment.

*Upper Lip* (Figure 42*k*): With small anterior process.

*Genitalia:* Copulatory lobes small.

*Anterior of Body* (Figure 42*k*): With broad anterior projection at midheight, unlike small anterior process of female.

*Posterior of Body* (Figure 42*j*): Posterior margin with long hairs.

Y-*Sclerite* (Figure 42*j*): Similar to that of female.

PARASITES.—BIOGAS XI, CP-37, juvenile with cyproniscid isopod.

COMPARISONS.—The new species *P. pentathrix* is closely related to *P. tetrathrix* Kornicker, 1975a. It differs in the distribution of primary and secondary claws on the caudal furca. Each lamella of the furca of *P. tetrathrix* bears 4 primary claws, whereas, each lamella of *P. pentathrix* bears 5 primary claws. However, on some specimens of *P. pentathrix* the lengths of the claws decrease gradually along the lamella and the claws are not readily divisible into primary and secondary. Another difference is that the 2nd joints of many endopodites of the 2nd antennae of the adult female of *P. pentathrix* bear 5 bristles, whereas, endopodites with 5 bristles were not observed on *P. tetrathrix*. Also, the 7th limbs of female *P. pentathrix* bear 21 bristles compared to 26–33 bristles for *P. tetrathrix*. The lengths of carapaces of female *P. pentathrix* (2.19–2.22 mm) are shorter than those of *P. tetrathrix* from the South Atlantic (2.61–2.78 mm) reported by Kornicker (1975a:257), but are longer than a female *P. tetrathrix* (1.91 mm) from the South Pacific near the Strait of Magellan (Kornicker, 1975a:257). The new species also resembles *P. linkoi* Chavtur, 1983, but differs in having 4 or 5 bristles intead of 2 on the 2nd endopodial joint of the 2nd antenna.

REMARKS.—The broken bristles on the exopodites of the 2nd antennae of ovigerous females of *P. pentathrix* indicate that the bristles break off after mating, and that females are then confined to the substrate.

### *Philomèdes* species indeterminate

MATERIAL.—BIOGAS VI, R.V. *Jean Charcot*, sta 4, sample CP-17: 1 A-1 male (USNM 193251).

REMARKS.—Specimen (USNM 193251) similar to *P. pentathrix*, but dorsal margin of mandibular basale with only 4 bristles, length 2.16 mm, height 1.27 mm; lateral eye about same size as medial eye, black with many ommatidia.

## PSEUDOPHILOMEDINAE Kornicker, 1967

The Pseudophilomedinae are represented in the collections by 1 species of the genus *Tetragonodon* Brady and Norman, 1896. A species of the genus *Angulorostrum* Kornicker, 1981 (*A. segonzaci* Kornicker, 1981), collected at a depth of 700 m in the Bay of Biscay, has been reported previously (Kornicker, 1981:13), but was not encountered in the present samples. Brady and Norman (1896:666) described the carapace of *Streptoleberis rectirostris* Brady and Norman, 1896, from a depth of 2794 m in the Bay of Biscay, but Müller (1912:52) referred the species to *Cypridinidarum* genera and species dubiae, a decision with which I concur (Kornicker, 1967:4, 1978:57, 1981:3).

### Key to Genera of Pseudophilomedinae

1. Tooth of 2nd exopodial joint of 5th limb of adult females and juvenile males and females with saber-like prolongation . . . . . 2
   Tooth of 2nd exopodial joint of 5th limb of adult females and juvenile males and females without saber-like prolongation (squarish) . . . . . 3
2. 7th joint of female 1st antenna with b-bristle . . . . . ***Pseudophilomedes***
   7th joint of female 1st antenna without b-bristle . . . . . ***Paramekodon***
3. Caudal furca with 3rd claw weaker than 4th . . . . . ***Harbansus***
   Caudal furca with 3rd claw not weaker than 4th . . . . . 4
4. Y-sclerite with ventral branch near mid-length; Bellonci organ segmented, elongate, fairly short . . . . . ***Angulorostrum***
   Y-sclerite without ventral branch near mid-length; Bellonci organ either absent, or short, nonsegmented . . . . . ***Tetragonodon***

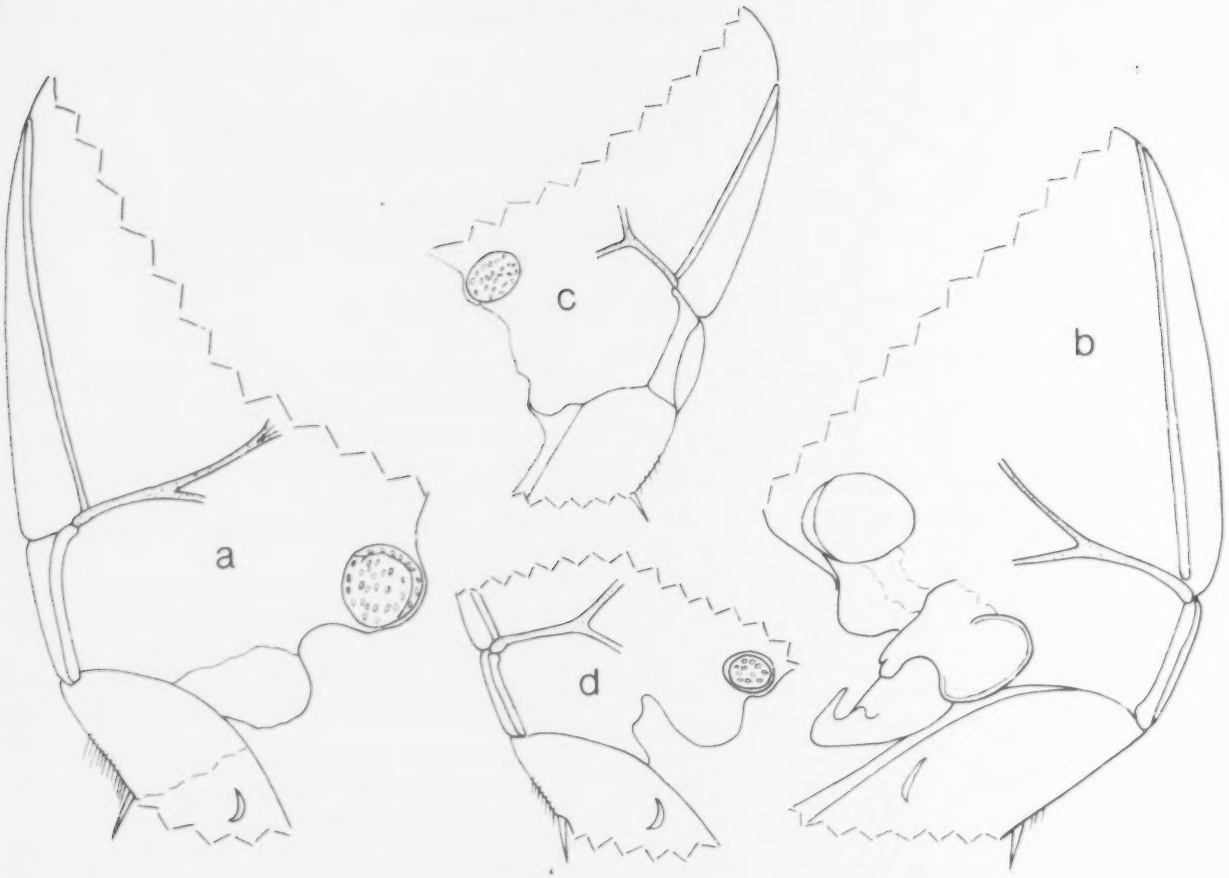



FIGURE 43.—Posterior of body of *Angulorostrum* species showing Y-sclerite (stippled): *a,b, A. monothrix* Kornicker: *a*, ovigerous female, length 1.56 mm, USNM 156960; *b*, adult male, length 1.63 mm, USNM 157814; *c, A. costatum* Kornicker, ovigerous female, 1.18 mm, USNM 156778; *d, A. segonzaci* Kornicker, ovigerous female, 1.36 mm, USNM 158133. (All drawn at same magnification.)

REVISION OF *Tetragonodon* AND *Angulorostrum*.—Kornicker (1981:1) proposed the new genus *Angulorostrum*, differing from the genus *Tetragonodon* in possessing an Organ of Bellonci (rod-shaped organ). Both genera are revised herein so that separation of the genera is based on a difference in morphology of their Y-sclerites rather than by the presence or absence of the Organ of Bellonci.

### *Angulorostrum* Kornicker, 1981

FIGURE 43

TYPE SPECIES.—*Angulorostrum monothrix* Kornicker, 1981:2.

REVISED DIAGNOSIS.—*First Antenna:* 2nd joint with only 1 bristle (dorsal).

*Fifth Limb:* Distal sclerotized part of 2nd exopodial joint of female and juveniles of both sexes short, squarish, without saber-like prolongation.

*Furca:* Each lamella with 7–9 claws decreasing in length and width posteriorly along lamella; claw 3 not weaker than claw 4.

*Bellonci Organ:* Segmented, elongate, but fairly short.

*Y-Sclerite* (Figure 43): With ventral branch at midlength; note ventral branch of female *A. monothrix* not as well developed as in other species.

DISCUSSION.—The Y-sclerites of known species of *Angulorostrum* (*A. monothrix* Kornicker, 1981, *A. costatum* Kornicker, 1981, *A. segonzaci* Kornicker, 1981) are illustrated (Figure 43) based on specimens in the collections of the National Museum of Natural History, to document the presence of a ventral branch on all the species. The presence of a ventral branch on the Y-sclerite differentiates *Angulorostrum* from *Tetragonodon*. Only *Angulorostrum segonzaci* has been reported from the Bay of Biscay (Kornicker, 1981:13).

**Key to Species of *Angulorostrum****

1. Carapace with lateral ribs . . . . . ***A. costatum***
   Carapace without lateral ribs . . . . . 2
2. Rostrum not projecting past valve edge; 2nd endopodial joint of female 2nd antenna with 1 bristle; ventral margin of 2nd endopodial joint of mandible with 3 bristles . . . . . ***A. monothrix***
   Rostrum projecting past valve edge; 2nd endopodial joint of female 2nd antenna with 2 bristles; ventral margin of 2nd endopodial joint of mandible with 4 bristles . . . . . ***A. segonzaci***

*Projection of rostrum reversed in 2nd couplet by Kornicker (1981:3)

### *Tetragonodon* Brady and Norman, 1896

*Tetragonodon* Brady and Norman, 1896:667. [See also discussion in Kornicker, 1968:450–451.]

TYPE SPECIES.—*Bradycinetus ctenorhynchus* Brady, 1887:199 (subsequent designation by Sylvester-Bradley, 1961:Q400).

DISTRIBUTION.—Two species of this genus have been described: *Tetragonodon ctenorhynchus* Brady, 1887, from off the west coast of Africa and Europe between 20°41′N and 38°38′N at depths of 636–2995 m; and *T. rhamphodes* (Kornicker, 1968), from the Gulf of Mexico at a depth of 1000–1200 m. Empty valves collected at shallower depths (7–152 m) in the Atlantic Ocean off Puerto Rico and in Colon Harbor, Panama, have been referred to *Tetragonodon*, but their identity must be questioned (Kornicker, 1968:451). A species from the west coast of Morocco, *T. erinaceus* Brady and Norman, 1896, was correctly referred by Müller (1912:51) to *Cypridinidarum* genera dubia et species dubiae (Kornicker, 1968:460; Kornicker and Caraion, 1977:32). A new species, *T. pellax*, described herein, collected at 1980–2006 m, extends the range of the genus north to the Bay of Biscay.

COMPOSITION.—One species in the collections from the Bay of Biscay (1980–2006 m) has been referred to *Tetragonodon pellax*, new species.

REVISED DIAGNOSIS.—*First Antenna:* 2nd joint with only 1 bristle (dorsal).

*Fifth Limb:* Distal sclerotized part of 2nd exopodial joint of female and juveniles of both sexes short, squarish, without saber-like prolongation.

*Furca:* Each lamella with 9 or 10 claws decreasing in length and width posteriorly along lamella; claw 3 not weaker than claw 4.

*Bellonci Organ:* Absent, or short, nonsegmented.

Y-*Sclerite* (Figure 46*l*): Without ventral branch.

DISCUSSION.—The Y-sclerite is known for only *T. ctenorhynchus* and *T. pellax*. *T. rhamphodes* has been referred to *Tetragonodon* rather than to *Angulorostrum* because of not having an Organ of Bellonci.

**Key to Species of *Tetragonodon***

1. Endopodite of female 2nd antenna with 3 bristles . . . . . ***T. rhamphodes***
   Endopodite of female 2nd antenna with 2 bristles . . . . . 2
2. Female shell with pointed rostrum; Bellonci organ absent . . . . ***T. ctenorhynchus***
   Female shell with rounded rostrum; small Bellonci organ present . . . . . ***T. pellax***

### *Tetragonodon pellax*, new species

FIGURES 44–50

*Angulorostrum* species A.—Kornicker, 1985:410–412.

ETYMOLOGY.—The species name from the Latin *pellax* (deceitful).

HOLOTYPE.—Adult female in alcohol, MNHN Os 148, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS VI, R.V. *Jean Charcot*, Gulf of Biscay, 44°04′36″N, 4°21′24″W, 1980 m, sta 6, sample CP-23a, 31 Oct 1974.

PARATYPES.—BIOGAS IV, R.V *Jean Charcot*, sta 6: sample DS-52, 1 adult female, + 3 adult females (USNM 158589, 158596, 159084). BIOGAS VI, R.V. *Jean Charcot*, sta 6:

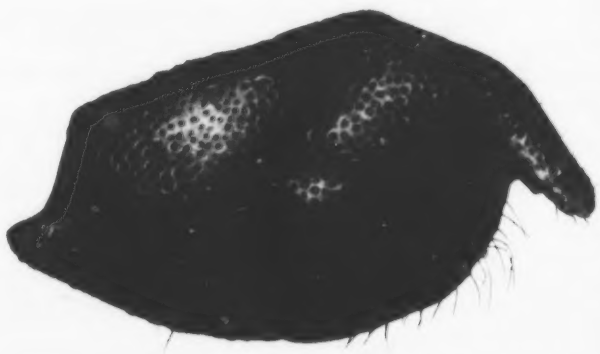


FIGURE 44.—*Tetragonodon pellax*, new species, adult female, holotype, MNHN Os 148, complete specimen, length 1.91 mm.

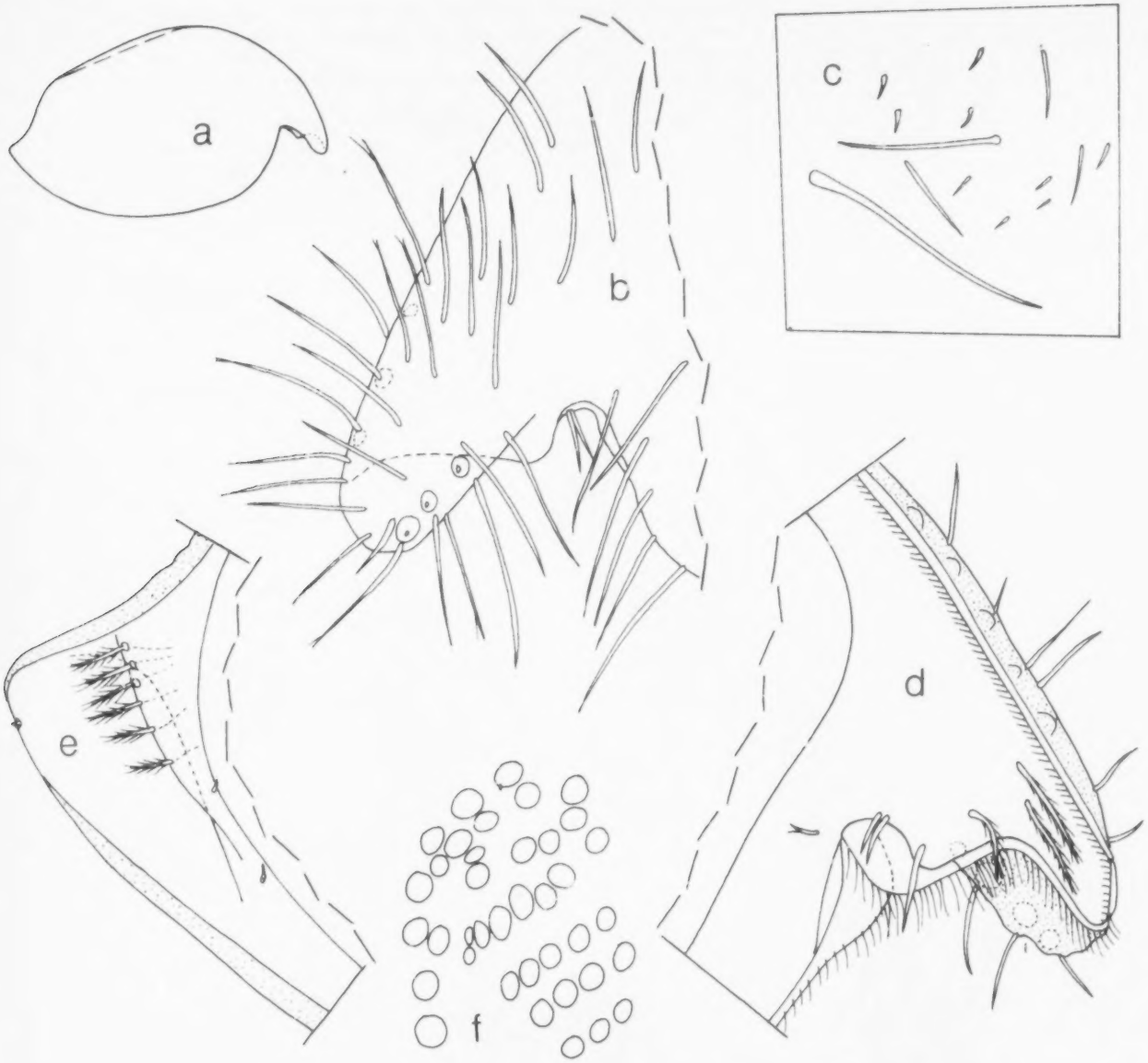



FIGURE 45.—*Tetragonodon pellax*, new species, ovigerous female, paratype, USNM 158589: *a*, complete specimen from right side, length 2.22 mm; *b*, anterior of left valve from outside; *c*, detail of bristles in posterodorsal quadrant of left valve. Adult female, holotype, length 1.91 mm: *d*, anterior of left valve from inside; *e*, cauda' process of left valve from inside; *f*, central adductor muscle attachment scars of right valve viewed from outside, anterior towards right.

sample CP-23a, 1 adult male (USNM 159085) + 4 adult males + 6 adult females + 2 juveniles (MNHN OS 149–152).

DISTRIBUTION.—Bay of Biscay, 1980–2006 m.

Description of Adult Female (Figures 44–47).—Carapace elongate with prominent rostrum and caudal process; rostrum with lateral overlap along ventral margin and with rounded tip; slight bulge in vicinity of central adductor muscles not observed on all specimens and probably preservation artifact (Figure 44); hinge long, straight, indented (Figure 45*a*); dorsal outline generally more arched than shown in Figure 44.

*Ornamentation* (Figures 44, 45*b,c*): Lateral surface with small fossae (Figure 44) and scattered long bristles and short spines (Figure 45*b,c*); rostrum with 3 or 4 small faint processes along ventral margin (Figures 44, 45*b,d*); additional faint processes along anterodorsal edge of valve (Figure 45*d*), near anteroventral corner, and scattered on valve surface.

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FIGURE 46 (left).—*Tetragonodon pellax*, new species, ovigerous female, paratype, USNM 158596, length 1.99 mm: *a*, anterior of body showing Bellonci organ, medial eye (stippled), and joints 1 and 2 of left 2nd antenna. Ovigerous female, paratype, USNM 158589: *b*, right 1st antenna, medial view; *c*, endopodite of right 2nd antenna, medial view; *d*, right maxilla (bristles of endites II and III not shown), medial view; *e*, exopodite of right maxilla viewed through limb shown in *d*; *f*, right 5th limb, posterior view; *g*, left 5th limb, anterior view; *h*, left lamella of furca; *i*, anterior of body showing bifurcate Bellonci organ, medial eye (stippled), anterior process, and upper lip; *j*, Bellonci organ, medial eye (stippled), and joints 1 and 2 of right 2nd antenna; *k*, Bellonci organ and medial eye (stippled), oblique view; *l*, posterior of body showing Y-sclerite (stippled) and girdle, and furca with only proximal claw shown.

FIGURE 47.—*Tetragonodon pellax*, new species, ovigerous female, paratype, USNM 158589: *a*, left mandible, lateral view; *b*, 6th limb; *c*, 7th limb.

FIGURE 48.—*Tetragonodon pellax*, new species, adult male, paratype, complete specimen, length 1.82 mm.

*Infold* (Figure 45*d,e*): Rostral infold with 4 bristles (some with faint marginal hairs) and 2 short bristles at inner end of incisur; infold immediately ventral to rostrum with small divided bristle (Figure 45*d*); anteroventral infold with 7 bristles paralleling valve margin; list of caudal process with 6 flat spinous bristles; inner edge of infold anterior to caudal process with 2 small bristles; outer edge of caudal process with 1 or 2 minute bristles.

*Selvage:* Wide fringed lamellar prolongation present along valve margin, except along hinge and outer edge of caudal process.

*Central Adductor Muscle Attachments* (Figure 45*f*): Consisting of about 40 small ovoid attachments.

*Size:* Holotype, length 1.91 mm, height 1.10 mm; USNM 158589, length 2.22 mm, height 1.29 mm; USNM 158596, length 1.99 mm, height 1.06 mm; USNM 159084, length 2.06 mm, height 1.19 mm; specimen from Biogas IV, sample DS-52, length 1.91 mm, height 1.56 mm.

*First Antenna* (Figure 46*b*): 1st joint bare. 2nd joint spinous, with 1 spinous dorsal bristle. 3rd joint short with few spines and 3 spinous bristles (1 ventral, 2 dorsal). 4th joint long, spinous, with 3 spinous bristles (2 ventral, 1 dorsal). Sensory bristle of long 5th joint with 4 marginal filaments (2 proximal, 2 near tip). Minute 6th joint with short spinous medial bristle. 7th joint: a-bristle spinous, about twice length bristle of 6th joint; b-bristle about 1/2 longer than a-bristle, with 3 marginal filaments (1 proximal, 2 near tip); c-bristle almost as long as sensory bristle of 5th joint, with 5 marginal filaments (2 or 3 proximal, 2 or 3 near tip). 8th joint: d- and e-bristles long, bare, with blunt tips; f- and g-bristles about same length as sensory bristle of 5th joint, with 5 marginal filaments (2 proximal, 3 near tip).

*Second Antenna* (Figure 46*c*): Protopodite bare. Endopodite 2-jointed; 1st joint with short proximal bristle; 2nd joint with long, spinous, subterminal, ventral bristle. Exopodite: 1st joint with minute, pointed, terminal, medial bristle; bristle of 2nd joint reaching well past 9th joint, about same length as joints 1 and 2 combined, bare except for 2 or 3 terminal hairs; bristles of joints 3–8 about 1/4 longer than bristle of 2nd joint, bare except for several hairs at tip (some distal bristles with tips missing on some specimens); 9th joint with 3 bristles (bare except for several hairs at tip); joints 3–8 with slender spines forming row along distal margin.

*Mandible* (Figure 47*a*): Coxale endite spinous, bifurcate at tip, without bristle near base. Basale: dorsal margin with 3 spinous bristles (1 distal to middle, 2 terminal); ventral margin with 1 spinous subterminal bristle; medial surface spinous, with 5 short, spinous bristles near ventral margin (4 proximal, 1 distal to middle); lateral surface spinous, with 4 spinous bristles forming row near ventral margin. Exopodite hirsute, about 1/2 length of 1st endopodial joint, with 2 subterminal bristles. 1st endopodial joint with medial spines and 3 ventral bristles. 2nd endopodial joint: medial and lateral surfaces spinous; dorsal margin with proximal spines, and bristles forming 2 groups with 2 bristles in proximal group and 5 in distal group; ventral margin with 4 spinous bristles forming 2 groups, 2 bristles in each group. End joint with 3 claws (dorsal claw minute, bare, others stout, with faint ventral spines) and 3 bristles.

*Maxilla* (Figure 46*d,e*): Endite I with 6 spinous bristles; endite II with 5 spinous bristles, and endite III with 7 spinous bristles (bristles of endites I and II not shown on illustrated limb). Precoxale and coxale with hirsute dorsal fringe; coxale with spinous dorsal bristle. Basale with 3 spinous bristles. Exopodite short, with 3 bristles (2 long, 1 short; Figure 46*e*). Endopodite: 1st joint with 1 spinous alpha-bristle and 1 or 2 beta bristles; end joint with 3 claws and about 4 bristles.

*Fifth Limb* (Figure 46*f,g*): 3 endites with total of about 20 bristles. Exopodite: 1st joint with main tooth comprising slender, pointed, proximal tooth with few minute spines and 3 pectinate distal teeth (distal pectinate tooth with rounded anterior part; small bristle present on 1st joint near outer corner of tooth of 2nd joint; posterior side of 2nd joint with bristles along inner edge; 3rd joint with 3 bristles on inner lobe and 2 on outer lobe; fused joints 4 and 5 with total of 5 spinous bristles.

*Sixth Limb* (Figure 47*b*): Endite I small with 3 short bristles; endite II with 3 terminal bristles; endite III broad, with 7 terminal bristles; endite IV narrower than 3rd, with 5 terminal bristles. End joint with 5 spinous bristles followed by 3 or 4 hirsute bristles (2 long, 1 or 2 short); 1 short bristle in place of epipodite.

FIGURE 49.—*Tetragonodon pellax*, new species, adult male, paratype, USNM 159085: *a*, complete specimen from left side, length 1.87 mm; *b*, 1st antenna; *c*, maxilla; *d*, posterior of body showing right lamella of furca, right copulatory organ, right Y-sclerite and girdle; *e*, left copulatory organ; *f*, anterior of body from right side showing medial view of joints 1 and 2 of left 1st antenna, broad anterior process, and upper lip; *g*, anterior of body from left side. *h*, adult male, paratype, length 1.82, height 0.99 mm, anterior of body showing small Bellonci organ, medial view of joints 1 and 2 of right 1st antenna, and broad anterior process.

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d
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h
b

*Seventh Limb* (Figure 47*c*): Proximal group with 6 bristles (3 on each side), each bristle with 3 bells; terminal group with 6 bristles (3 on each side), each bristle with 2–6 bells; each bristle with marginal spines. Terminus consisting of comb of 9 teeth opposite 4 short pegs (3 with rounded tips, 1 longer with pointed tip).

*Furca* (Figure 46*h,i*): Each lamella with 9 claws, each separated from lamella by suture and decreasing in length and width posteriorly along lamella. Medial side of claw 1 with 1 or 2 large teeth distally and smaller teeth proximally; posterior edge of claw 1 with small teeth of varying length proximally and very small teeth on distal third; remaining claws with proximal teeth stouter than distal teeth; long hairs present on lamellae between claws and following claws.

*Bellonci Organ* (Figure 46*a,i–k*): Short, tapering to point, bifurcate on USNM 158589 (aberrant?).

*Eyes:* Lateral eyes absent. Medial eye represented by area at base of bellonci organ pigmented light amber (Figure 46*a,i–k*).

*Upper Lip* (Figure 46*i*): Projecting anteriorly, with minute processes on tip.

*Anterior of Body* (Figure 46*a,i,j*): With rounded process between bellonci organ and upper lip.

*Posterior of Body* (Figure 46*l*): Spines present on poster-dorsal margin dorsal to girdle.

Y-*Sclerite* (Figure 46*l*): Without ventral branch.

*Eggs:* USNM 158589 with 5 eggs in marsupium; USNM 158596 with 3 eggs; USNM 159084 with 5 eggs; specimen from BIOGAS VI, sta 6, sample CP-23a with 3 eggs.

*Parasites:* Holotype with 8 unidentified eggs in marsupium.

DESCRIPTION OF ADULT MALE (Figures 48–50).—Carapace similar in shape to that of adult female except for slightly shorter rostrum (Figures 48, 49*a*).

*Ornamentation:* Surface processes less numerous and less evident than on female, only 1 observed along ventral margin of rostrum. Surface hairs and spines about same as on female; caudal process without long hairs present on male of *Tetragonodon ctenorynchus* (see Kornicker and Caraion, 1977, fig. 28b).

*Infold, Selvage, Central Adductor Muscle Attachments:* Similar to those of adult female.

*Size:* Four specimens from BIOGAS VI, sta 6, sample CP-23a: USNM 159085, length 1.87 mm, height 1.05 mm; length 1.82 mm, height 0.99 mm; length 1.82 mm, height 1.08 mm (Figure 48); length 1.81, height 1.04 mm.

*First Antenna* (Figure 49*b*): 1st joint bare. 2nd joint spinous, with 1 spinous dorsal bristle. 3rd joint with short ventral margin and 3 bristles (1 ventral, 2 dorsal). 4th joint with proximal ventral bristle and distal dorsal bristle. 5th joint wedged ventrally between 4th and 6th joints; sensory bristle with abundant filaments on proximal bulbous part; stem with 4 marginal filaments and bifurcate tip. Long 6th joint with medial bristle at distal dorsal corner. 7th joint: a-bristle similar in length to bristle of 6th joint; b-bristle about 1/2 longer than a-bristle, with 3 marginal filaments and bifurcate tip; c-bristle very long, with 11 short marginal filaments. 8th joint: d- and e-bristles bare, reaching past sensory bristle of 5th joint and more than twice length of a-bristle; f-bristle similar to c-bristle; g-bristle about same length as d- and e-bristles, with 4 marginal filaments and bifurcate tip.

*Second Antenna* (Figure 50*a*): Protopodite bare. Endopodite 3-jointed (Figure 50*a*): 1st joint with 3 or 4 small bristles; 2nd joint elongate with 2 long bristles near middle; 3rd joint elongate, reflexed on 2nd, with 2 small subterminal bristles and knife-like tip. Exopodite: 1st joint with small, medial, terminal bristle bearing few spines; 2nd joint only slightly longer than 3rd joint, and 3rd joint only slightly longer than 4th; bristle of 2nd joint reaching well past 9th joint, about same length as joints 1–3 combined, with natatory hairs, no spines; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 3 bristles (1 long, 1 medium, both with natatory hairs, 1 short with few marginal hairs); joints 3–8 with short spines forming lateral row near ventral edge.

*Mandible* (Figure 50*b*): Coxale endite consisting of 2 broad triangular spines. Basale: medial surface spinous with 4 short bristles near midlength, and long spinous subterminal bristle; ventral margin with 3 long spinous bristles with bases on lateral side of margin; dorsal margin with 3 bristles (1 distal to midlength, 2 terminal). Exopodite hirsute distally, about 2/3 length of 1st endopodial joint, with 2 subterminal bristles. 1st endopodial joint with medial spines and 3 ventral bristles (2 long, spinous, 1 short, bare). 2nd endopodial joint: medial surface and ventral margin spinous; dorsal margin with bristles forming 2 groups with 2 bristles in proximal group and 5 in distal group; ventral margin with distal bristles forming 2 groups with 2 bristles in each group. End joint with 3 bare claws (dorsal of these short) and 3 short bristles.

*Maxilla* (Figure 49*c*): Limb reduced. Precoxale and coxale with fringe of hairs; coxale with hirsute dorsal bristle. Endites I and II each with 6 unringed bristles; endite III with 4 unringed and 3 ringed bristles (some with marginal spines). Basale hirsute, with 3 bristles (2 ventral, 1 dorsal). Exopodite short, with 3 bristles (2 long, hirsute, 1 short, bare). 1st endopodial joint hirsute, with 1 alpha- and 2 beta-bristles (endopodite twisted in illustrated limb). End joint with 10 bristles, some with rings, some also with marginal spines.

*Fifth Limb* (Figure 50*c*): Limb weakly developed. Endite I with 2 small bristles; endite II with 4 small bristles; endite III with 6 or 7 small bristles. Exopodite: 1st joint with 5 small bristles; 2nd joint with 4 slender bristles and 1 stout bristle terminating in sclerotized, triangular tooth. Inner lobe of 3rd joint with 2 slender bristles and 2 short triangular bristles, outer lobe with 2 slender, ringed, spinous bristles. 4th and 5th joints fused, hirsute, with total of 5 bristles (without rings).

*Sixth Limb* (Figure 50*d*): Limb hirsute. Endite I with 2 small bristles; endite II narrow, with 3 terminal bristles; endite III wider than endite II, with 6 terminal bristles; endite IV

FIGURE 50.—*Tetragonodon pellax*, new species, adult male, paratype, USNM 159085: *a*, endopodite of right 2nd antenna, medial view; *b*, right mandible, medial view; *c*, 5th limb; *d*, 6th limb; *e*, 7th limb.

wider than endite III, with 5 terminal bristles. End joint with 6 bristles (2 lateral, hirsute, 4 others with long proximal and short distal spines) followed by 2 stout extremely hirsute bristles. One bristle in place of epipodite.

*Seventh Limb* (Figure 50*e*): Proximal group with 2–4 bristles, each with marginal spines and 2–4 bells; terminal group with 3 or 4 bristles (1 or 2 on each side), each with marginal spines and 5 or 6 bells; total number of bristles 5–8. Terminus consisting of comb with 8 or 9 alate teeth opposite 3 short pegs.

*Furca* (Figure 49*d*): Similar to that of adult female except without large medial teeth on claw 1.

*Bellonci Organ* (Figure 49*h*): Very small, cylindrical, with minute terminal spine. (Organ not observed on USNM 159085, Figure 49*f,g*).

*Eyes:* Lateral eyes and medial eye absent.

*Upper Lip* (Figure 49*f,g*): Similar to that of adult female.

*Genitalia* (Figure 49*d,e*): Each copulatory organ with long terminal hook-like process.

*Anterior of Body* (Figure 49*f–h*): With large, rounded process between Bellonci organ and upper lip.

*Posterior of Body* (Figure 49*d*): Without posterodorsal spines present on female.

Y-*Sclerite* (Figure 49*d*): Similar to that of female (without ventral branch).

COMPARISONS.—*Tetragonodon pellax* differs from *T. ctenorynchus* in having on the female shell a rounded rather than pointed rostrum and minute processes on the valve surface (for example, along ventral margin of rostrum, Figure 45*b*), and in the male shell not having a cluster of long bristles on the outer surface of the caudal process. *Tetragonodon pellax* bears a small Bellonci organ absent on *T. ctenorhynchus*.

## CYLINDROLEBERIDIDAE Müller, 1906

The Cylindroleberididae comprise 3 subfamilies: Cylindroleberidinae, Cyclasteropinae, and Asteropteroninae. Only the first is represented in the collections reported upon herein. The other two subfamilies are generally restricted to the shelf and upper slope elsewhere.

## CYLINDROLEBERIDINAE Müller, 1906

The Cylindroleberidinae are represented in the collections by 2 species of *Parasterope* Kornicker, 1975, 4 species of *Synasterope* Kornicker, 1975, and 2 species of *Prionotoleberis* Kornicker, 1974, and 1 species of *Domromeus*, new genus. Two species of the genus *Cylindroleberis* Brady, 1868 have been reported previously from the Bay of Biscay: *C. elliptica* (Philippi, 1840) (Brady and Norman, 1896:634) from unknown depth, and *C. mariae* (Baird, 1850) (Brady, 1872:59, Brady and Norman 1896:633, Fischer, 1876:248, 250, Yassini, 1969:13–14) from depths of 2–460 m (Yassini, 1969:13; Fischer, 1876:248, 250), but were not in the present collection. Both species bear well-developed lateral eyes (Philippi, 1840, pl. 3: fig. 11; Sars, 1922, pl. 9) and probably do not live at abyssal depths.

During the present study I examined the holotype and a paratype of the type species of the genus *Archasterope*, *A. dentata* Poulsen, 1965, from southeast of Australia, and have included a brief discussion of the specimens.

### *Parasterope* Kornicker, 1975

*Parasterope* Poulsen, 1965:361 [nomen nudum].—Kornicker, 1975a:401.

TYPE SPECIES.—*Asterope muelleri* Skogsberg, 1920 (designation by Kornicker, 1975a:401).

DISTRIBUTION.—Members of *Parasterope* are widespread between latitudes of 55°N to 65°S with a depth range of intertidal depths to 4303 m (Kornicker and Caraion, 1974:7). The depth range in and west of the Bay of Biscay is 1560–3742 m.

COMPOSITION.—Two species were collected in the Bay of Biscay, *P. styx* Kornicker, 1975a, and *P. antyx*, new species.

**Key to Species of *Parasterope* in This Study**

6th limb with more than 1 bristle dorsal to upper suture of anterior margin . . . . ***P. styx***
6th limb with 1 bristle dorsal to upper suture of anterior margin . . . . . ***P. antyx***

### *Parasterope styx* Kornicker, 1975

FIGURES 51–54

*Parasterope styx* Kornicker, 1975a:432, figs. 270, 271.

*Parasterope* species A.—Kornicker, 1985:410–412 [part, only specimens from sample DS-60].

*Parasterope* species B.—Kornicker, 1985:410–412 [part, excluding specimen from sample DS-55 referred to *Synasterope hirpex*, herein].

HOLOTYPE.—Ovigerous female, length 2.01 mm, USNM 137259.

TYPE LOCALITY.—Vema Cruise 17, 37°57′S, 75°08′W, South Pacific, west of Chile, 4303 m, sta V-17-6.

MATERIAL.— BIOGAS III, R.V. *Jean Charcot*, sta 2: sample DS-41: 1 adult female (USNM 158585) + 1 adult male (USNM 193255). BIOGAS IV, R.V. *Jean Charcot*, sta 1: sample DS-60: 1 instar I + 1 adult female (USNM 193254). BIOGAS V, sta 2: sample DS-66: 1 A-1 female. BIOGAS VI, R.V. *Jean Charcot*, sta 2: sample DS-75: 1 A-1 female.

DISTRIBUTION.—West of Bay of Biscay and west of Chile, 3250–4303 m.

SUPPLEMENTARY DESCRIPTION OF ADULT FEMALE (Figures 51, 52).—Carapace oval in lateral view with incisur below valve middle (Figure 51*a,f*).

*Infold* (Figure 51*f,g*): Infold behind rostrum with about 33 bristles between list and outer margin, about 6 on rostral list, and about 10 bristles between list and incisur; single bristle on list near inner end of incisur. Broad list ventral to incisur with about 30 bristles. Infold along ventral margin with about 23 bristles. List present starting near inner margin of anterior part of infold below incisur, extending along ventral infold, and continuing on posterior infold where it broadens; broad posterior list with about 30 transparent flap-like bristles and about 25 small bristles (generally 1 small bristle between adjacent flap-like bristles, but a few small bristles forming pairs between adjacent flap-like bristles). A single bristle between posterior end of list and posterior margin of valve observed only on right valve. A small indistinct process present between broad posterior list and edge of left valve near dorsal end; process absent on right valve.

*Vestment* (Figure 51*g*): Slender spines forming rows present on vestment lining anterodorsal, posterior and posterodorsal parts of valves proximal to inner margin of infold.

*Size:* USNM 193254, length 1.86 mm, height 1.34 mm; USNM 158585, length 2.00 mm, height 1.42 mm.

*First Antenna* (Figure 51*e,h,i*): 1st joint with medial and lateral hairs and spines. 2nd joint with medial, lateral, dorsal and ventral spines and 2 bristles (1 dorsal with stout marginal spines, 1 lateral with short marginal spines). 3rd joint with well-defined distal margin, minute spines on ventral margin and forming short row on lateral surface, short bristle on ventral margin, and 6 spinous dorsal bristles in 5 groups of 1, 1, 1, 1, and 2 bristles (medial bristle of distal pair with short marginal spines, others with long proximal spines). 3rd plus 4th joints longer than wide; 4th joint with slightly concave distal margins, short medial spines forming rows near dorsal margin, and 3 bristles with short marginal spines (1 ventral, 2 dorsal). 5th joint with stiff distal spines on dorsal margin and smaller spines at midlength; minute lateral spines forming rows near dorsal margin at midlength and terminal; sensory bristle with 6 terminal filaments (proximal 2 slightly more slender than others; tips of filaments and stem not shown on illustrated limb). 6th joint with stout medial bristle with short marginal spines. 7th joint: a-bristle claw-like, (tip broken off on both limbs of specimen examined, marginal spines absent from stumps); b-bristle with 3 distal filaments (with marginal hairs) excluding stem; c-bristle with tip broken of on illustrated limb, 6 filaments on remaining part. 8th joint: d-bristle minute, represented by peg with rounded tip; e-bristle broken off on illustrated limb, bare, well developed; f-bristle bent dorsally, tip missing on illustrated limb but with 4 marginal filaments on remaining part (distal of these with short marginal hairs); g-bristle with tip broken off on illustrated limb, with 4 filaments on remaining part.

*Second Antenna* (Figure 51*j*): Protopodite with small distal medial bristle and spines forming rows along dorsal margin and dorsal part of medial surface. Endopodite 3-jointed, with well-defined sutures separating joints; terminal filament about 3 times length of stem. Exopodite: 1st joint with long hairs forming rows along distal inner margin; bristle of 2nd joint reaching past 9th joint and with numerous spines along ventral margin; bristles of joints 3–8 with natatory hairs, some with few indistinct ventral spines near midlength; 9th joint with 4 bristles (2 long with natatory hairs, 2 short with short marginal spines); joints 3–8 with short basal spines and minute spines forming short row along distal dorsal edge; 9th joint with short pointed lateral spine about 1/3 length of joint.

*Mandible* (Figure 51*k*): Coxale endite broken off both limbs of specimen examined. Basale endite with glandular peg, 4 end bristles, 3 triaenid bristles with 5–7 pairs of marginal spines excluding terminal pair, and 1 dwarf bristle about 1/2 length of triaenid bristle. Basale: ventral margin with U-shaped sclerotized area, and short stout spines forming row (bases of most spines on lateral side); dorsal margin with 2 long spinous terminal bristles; medial surface with slender spines forming rows at midheight of joint. Exopodite with hirsute tip and 2 terminal bristles reaching proximal end of 1st endopodial joint. 1st endopodial joint with 3 long spinous ventral bristles. 2nd endopodial joint: ventral margin with 3 long spinous terminal bristles; dorsal margin with short proximal bristle about 1/4 length of a-bristle, and stout spinous a-, b-, c-, and d-bristles; medial surface with spines forming rows, 1 cleaning bristles just distal to base of b-bristle, 4 cleaning bristles forming oblique row near base of c-bristle, and 1 long bristle (with short marginal spines) just distal to base of d-bristle; lateral surface with 1 long bristle (with short marginal spines) between b- and c-bristles, and 1 long bristle (with short marginal spines) between c- and d-bristles. End joint with long dorsal claw with slender spines along middle of inner margin, and 5 spinous bristles. (Not all marginal spines shown on illustrated bristles.)

*Maxilla* (Figure 52*a*): Epipodite elongate, hirsute with tapering tip. Endite I with 1 short and 3 long bristles; endite II with 3 long bristles. Basale hirsute; medial surface with 1 proximal bristle near midheight and 1 distal bristle near dorsal margin; ventral margin with fairly long proximal bristle and long, stout, spinous, terminal bristle; proximal lateral bristle not observed (possible obscured). 1st endopodial joint with long hairs forming row, 1 short anterior bristle, and 1 long spinous terminal bristle; 2nd joint with long spinous terminal bristle. (Not all marginal spines shown on illustrated bristles.)

*Fifth Limb* (Figure 52*b*): Epipodite with about 70 bristles. Stout plumose exopodial bristle reaching past distal end of comb; 1 slender bristle just ventral to base of stout bristle and 5 bristles near ventral margin of comb (distal of these more slender than others).

*Sixth Limb* (Figure 51*l*): Trunk: anterodorsal corner with small ringed medial bristle; anterior margin without bristle at lower suture and 5 or 6 medial bristles dorsal to upper suture.

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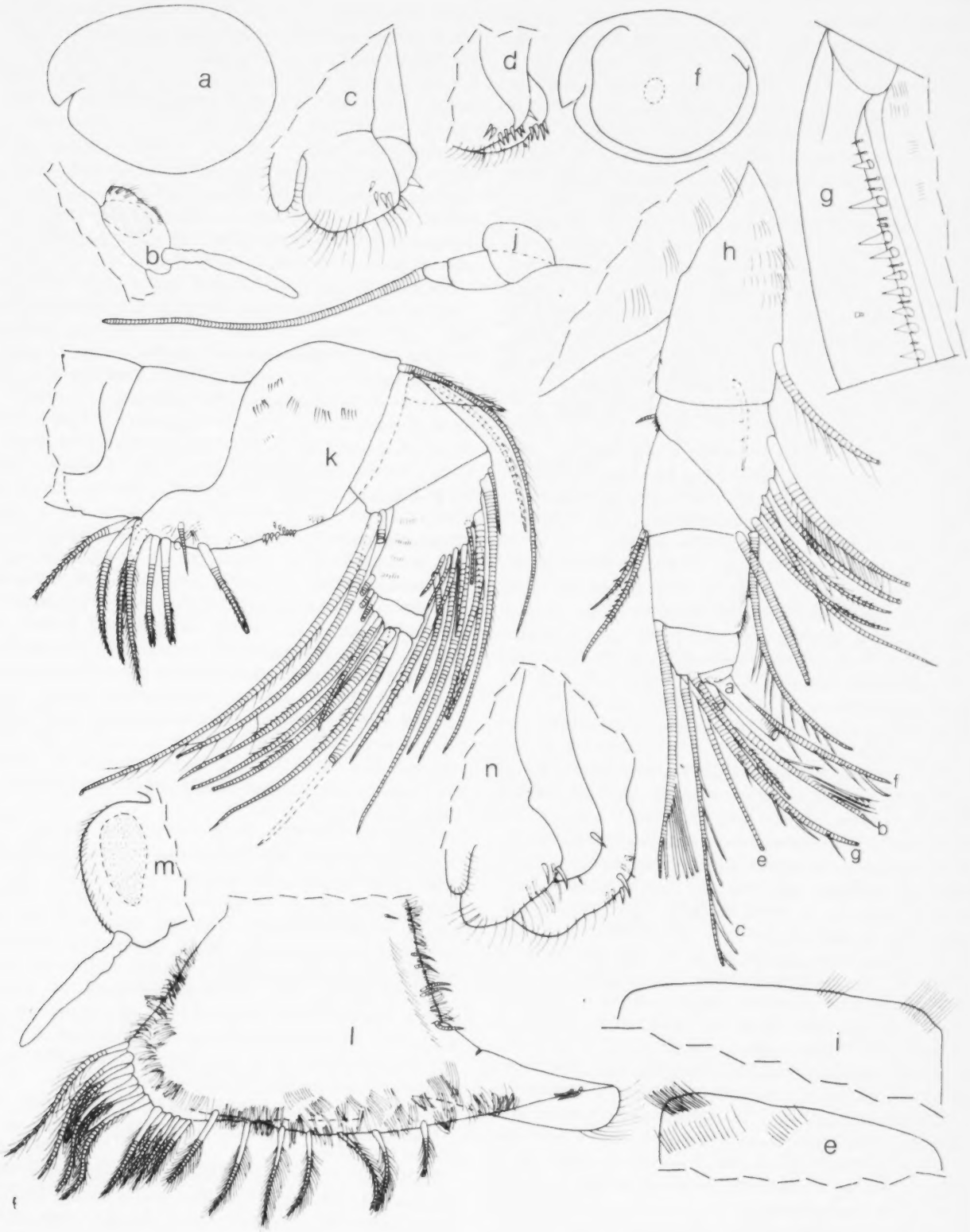
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Skirt: anteroventral corner with 1 or 2 slender bristles; posteroventral margin with 17 bristles; lateral flap with anterior hairs but no bristles. Medial and lateral surfaces and margins of limb hirsute.

*Seventh Limb* (Figure 52*c*): One limb with 13 bristles, 7 in proximal group (3 + 4) and 6 in distal group (3 + 3); other limb with 6 bristles in proximal group (3 + 3) and distal bristles unknown (broken off); each bristle with 2–4 bells. Terminus with opposing combs, each with 8 or 9 teeth (each tooth comprising spinous outer part and smooth tipped inner part).

*Furca* (Figure 52*d*): Each lamella with 9 claws including 3 ringed bristle-like claws; primary claws with long and short teeth along posterior margins and some with thin hairs along anterior margins; claw 1 of right lamella anterior to claw 1 of left lamella.

*Bellonci Organ* (Figure 51*b,m*): Elongate broadening near middle, with rounded tip.

*Eyes* (Figure 51*b,m*): Medial eye with nucleus of dark brown pigment when viewed in transmitted light and with marginal hairs. Lateral eyes absent.

*Upper Lip* (Figures 51*c,d,n*, 52*e*): Comprising 2 hirsute lobes (each with 6 spines) separated by saddle with 2 or 3 spines (Figure 52*e*). In lateral view all spines may not be visible (Figure 52*c*). Hirsute lateral flap present on each side of mouth (Figures 51*c,n*, 52*e*).

*Posterior of Body* (Figure 52*d*): Margin just dorsal to furca with minute spines; segment dorsal to midheight of posterior with long hairs along ventral 1/3 and slender spines on dorsal 2/3; posterodorsal corner broadly rounded and bearing spines forming short rows. Gill-like structures narrow, poorly defined except at distal ends.

Y-*Sclerite* (Figure 52*d*): Typical for subfamily.

*Parasites:* USNM 193254 + 2 A-1 females from DS-66, -75 with cyproniscid isopod (either juvenile or adult male) within carapace.

DESCRIPTION OF ADULT MALE (Figures 53, 54).—Carapace more elongate than that of female and with more open incisur; hairs forming vertical row near posterior end (Figure 53*a*).

*Infold:* Not examined.

*Size:* USNM 193255, length 2.44 mm, height 1.64 mm.

*First Antenna* (Figure 53*b*): 1st joint with medial and lateral hairs and spines; 2nd joint with medial, lateral, ventral, and dorsal spines and hairs and 2 bristles (1 dorsal with stout marginal spines proximally and more slender hairs distally, 1 lateral with long proximal and short distal hairs). Suture between 2nd and 3rd joints and 3rd and 4th joints oblique; trapezoidal 3rd joint with small bristle on short ventral margin, and on long dorsal margin 6 spinous bristles in 5 groups of 1, 1, 1, 1, and 2 bristles (all bristles with long proximal and short distal spines). 4th joint trapezoidal with 1 stout bristle (with short marginal spines) on short dorsal margin and 2 slender bristles (with short marginal spines) on long ventral margin. 5th joint short, without spines (spines present on female 5th joint); sensory bristle stout with abundant filaments. 6th joint with numerous muscles forming bundle narrowing distally; medial bristle with base near dorsal margin (bristle about same length as combined joints 5–8, and with short marginal spines). 7th joint: a-bristle claw-like, broken on both limbs of specimen examined; b-bristle about twice length of bristle of 6th joint, with about 5 marginal filaments and long slender bare tip; c-bristle very long, with short section of tip missing on specimen examined, and with 33 short filaments on remaining part. 8th joint: d-bristle absent; e-bristle about 1/2 length of b-bristle, bare with blunt tip; f-bristle similar to c-bristle; g-bristle about twice length of b-bristle, with about 10 filaments.

*Second Antenna* (Figure 53*c*): Protopodite with small distal medial bristle. Endopodite 3-jointed: 1st joint bare, about 4/5 length of 2nd joint; 2nd joint with 2 bristles distal to midlength; 3rd joint with long proximal filament, 6 rounded processes on margin just distal to filament, and pointed tip with 3 or 4 ridges along inner edge. Exopodite: elongate 1st joint with short spines forming rows along ventral margin and longer spines near distal end; 2nd joint about same length as combined joints 3–5; bristles of joints 2–8 long, with natatory hairs; 9th joint with 3 long bristles with natatory hairs (a 4th bristle probably broken off on limb examined); joints 2–8 with fairly long spines forming row along distal margin; 9th joint with short lateral spine with spines along flat distal end.

*Mandible* (Figure 54*a*): Coxale endite broken off both limbs of specimen examined. Basale: endite similar to that of adult female; dorsal margin with fairly long bare midbristle and 2 stout spinous terminal bristles; medial surface with small spines forming rows near midheight; ventral margin and lateral surface without short stout spines present on adult female. Exopodite similar to that of adult female. 1st endopodial joint longer than that of female but with similar bristles. 2nd endopodial joint: ventral margin with 3 long spinous terminal bristles; dorsal margin with 2 proximal bristles (proximal of these about 1/3 length, and distal about 2/3 length of a-bristle), stout a-, b-, c-, and d-bristles (all with marginal spines); medial surface with 1 or 2 cleaning bristles between b- and c-bristles but closer to b-bristle, 5 cleaning bristles forming oblique row near base of c-bristle, and 1 long bristle (with short marginal spines) just distal to base of d-bristle, and spines forming rows;

FIGURE 51.—*Parasterope styx* Kornicker, 1975a, adult female, USNM 158585: *a*, complete specimen from left side, length 2.00 mm; *b*, medial eye and Bellonci organ; *c*, upper and lower lips, anterior towards right. Ovigerous female, holotype, USNM 137259, length 2.01 mm: *d*, upper lip, anterior towards right; *e*, lateral spines on distal end of 5th joint of left 1st antenna. Adult female, USNM 193254, length 1.86 mm: *f*, inside view of right valve showing inner margin of infold and location of central adductor muscle attachment scars (dashed oval); *g*, dorsal end of posterior end of left valve from inside showing bristles of list and process on infold posterior to list; *h*, left 1st antenna, medial view; *i*, lateral spines on distal end of 5th joint of right 1st antenna; *j*, endopodite of left 2nd antenna, medial view; *k*, left mandible (coxale endite not shown), medial view; *l*, left 6th limb, medial view; *m*, medial eye and Bellonci organ; *n*, upper lip.

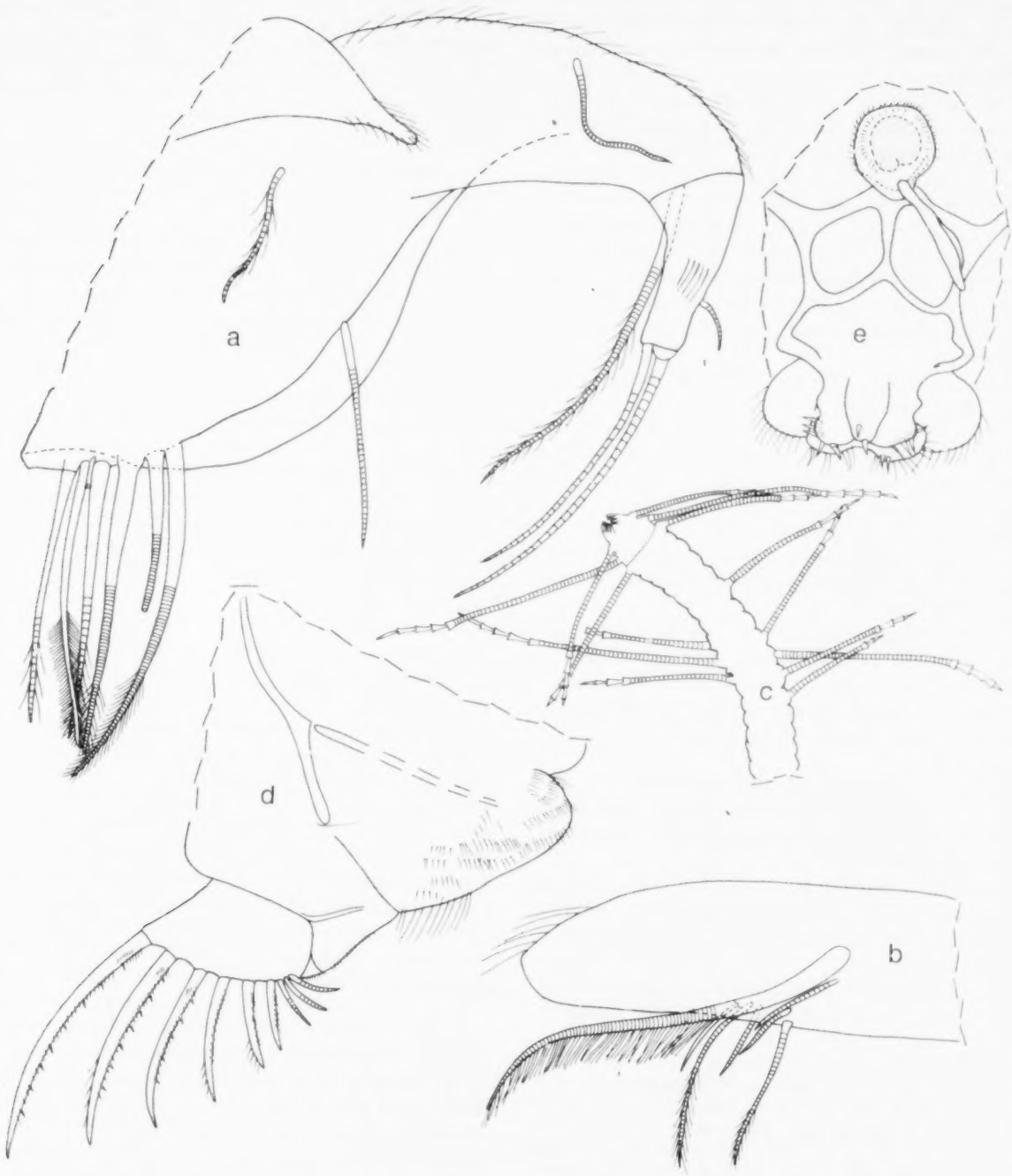


FIGURE 52.—*Parasterope styx* Kornicker, adult female, USNM 193254: *a*, left maxilla, medial view; *b*, comb of left 5th limb (ventral bristles not shown), lateral view; *c*, 7th limb; *d*, posterior of body showing left lamella of furca, Y-sclerite, part of girdle (dashed), rounded dorsum, and hairs and spines on posterior; *e*,anterior view of anterior of body showing medial eye and Bellonci organ, upper lip, lower lip (lateral hirsute flaps on each side of upper lip), and internal sclerites (paired ovoid areas ventral to medial eye represent places of attachment of 1st antennae).

FIGURE 53.—*Parasterope styx* Kornicker, adult male, USNM 193255: *a*, complete specimen from left side showing location of central adductor muscle attachment scars (dashed oval), length 2.44 mm; *b*, left 1st antenna, lateral view; *c*, endopodite of 2nd antenna; *d*, right maxilla, medial view; *e*, endites and axe-shaped bristle of left maxilla, medial view; *f*, comb of right 5th limb, lateral view; *g*, posterior of body showing copulatory appendage, left lamella of furca, Y-sclerite and girdle, and spines and hairs on posterior margin (anus is represented by dashed paired lines immediately in front of furca).

FIGURE 54.—*Parasterope styx* Kornicker, adult male, USNM 193255: *a*, right mandible (coxale endite not shown), medial view; *b*, left 6th limb, lateral view; *c*, 7th limb; *d*, medial eye and Bellonci organ and medial view of 1st joint of right 1st antenna; *e*, upper and lower lips, anterior towards right.

lateral surface with long bristle (with short marginal spines) between b- and c-bristles (broken off on illustrated right limb but present on left limb), and 1 long bristle (with short marginal spines between c- and d-bristles. End joint similar to that of female.

*Maxilla* (Figure 53*d,e*): Similar to that of adult female except marginal spines not observed on teminal bristle of 2nd endopodial joint.

*Fifth Limb* (Figure 53*f*): Similar to that of adult female.

*Sixth Limb* (Figure 54*b*): Trunk: anterodorsal corner with small ringed bristle with slender tip; anterior margin without bristle at lower suture and 5 medial bristles dorsal to upper suture. Skirt: anteroventral corner with 1 slender bristle; posteroventral margin with 14 hirsute bristles; lateral flap with anterior hairs but no bristles. Medial and lateral surfaces and margins hirsute.

*Seventh Limb* (Figure 54*c*): Single limb examined with 12 bristles, 6 in proximal group (3 on each side) and same number and distribution in distal group; each bristle with up to 4 bells. Terminus with opposing combs, each with 7 or 8 teeth similar to those of female.

*Furca* (Figure 53*g*): Each lamella with 8 claws including 2 ringed bristle-like claws which follow the 6 primary claws; claw 1 of examined specimen with very sparsely distributed teeth along posterior margin; claws 2–6 with numerous long and short teeth along posterior margins and hairs along anterior margins; bristle-like claws with few marginal spines; claw 1 of right lamella anterior to claw 1 of left lamella.

*Bellonci Organ* (Figure 54*d*): Similar to that of female.

*Eyes* (Figure 54*d*): Medial eye with light brown pigment when viewed in transmitted light and with indistinct marginal hairs. Lateral eyes absent.

*Upper Lip* (Figure 54*e*): Left and right lobes each with 3 or 4 anterior spines; middle saddle with 1 stout and 2 minute anterior spines.

*Posterior of Body* (Figure 53*g*), Y-*Sclerite:* In general, similar to that of adult female.

*Genitalia* (Figure 53*g*): Lobate with few bristles.

*Parasites:* USNM 193255 with cyproniscid isopod (either juvenile or adult male) within carapace.

REMARKS.—Kornicker (1975a:436, fig. 270n) described the upper lip of this species as having 2 spines on each lobe and 1 spine on the saddle between lobes, and illustrated the upper lip of the holotype. Because the specimens from the Gulf of Biscay have many spines on the upper lip, the upper lip of the holotype was reexamined and found to have 4 or 5 spines on each lobe and 3 spines on the saddle (Figure 51*d*). The spines on the inner side of the lateral lobes are difficult to see when lip is viewed laterally.

### *Parasterope antyx*, new species

FIGURES 55–57

*Parasterope* species A.—Kornicker, 1985:410–412 [part, excluding specimens from sample DS-60 referred to *Parasterope styx*, herein].

ETYMOLOGY.— From the Greek *antyx* (edge, rim, or frame).

HOLOTYPE.—Ovigerous female, length 1.44 mm, in alcohol, MNHN Os 256, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS I, R.V. *La Perle*, west of Bay of Biscay, 47°39′N, 8°11′48″W, 1560 m, sta Hors-Zone, sample DS-14, 10 Aug 1972.

PARATYPES.—BIOGAS I, R.V. *La Perle*, sta Hors-Zone: sample DS-14 (same sample as holotype), 1 ovigerous female on slide and in alcohol (USNM 157977; carapace lost) + 1 ovigerous female (USNM 193252) + 1 A-1 male (USNM 193253) + 2 adult females + 1 A-1 female (MNHN 9s 257).

DISTRIBUTION.—West of Bay of Biscay, 1560 m.

DESCRIPTION OF ADULT FEMALE (Figures 55, 56).—Carapace ovoid in lateral view with broadly rounded posterior margin; incisur ventral to midheight (Figure 55*a,d*).

*Infold* (Figure 55*b,c*): Rostral infold with bristles between list and anterodorsal margin of valve and total of 7 bristles on list and between list and incisur (Figure 55*b;* not all bristles shown on illustration); 1 bristle present at inner end of incisur; anteroventral infold with 5 bristles (Figure 55*b;* not all bristles shown on illustration); ventral infold between broad anteroventral infold and anterior end of broad posteroventral list with 9–11 bristles. Broad posteroventral list with 18–20 flap-like bristles and 9 or 10 minute bristles (not more than 2 minute bristles between each pair of flap-like bristles); no bristles or processes present between broad posteroventral list and edge of valve (Figure 55*c*); right valve only with small bristle near posterior juncture just dorsal to end of broad posteroventral list.

*Selvage:* Broad lamellar prolongation (with long fringe) along inner half of lower margin of incisur. Short segment with long fringe present near posterior juncture of hinge of right valve just anterior to single bristle. Elsewhere lamellar prolongation narrow and without marginal fringe.

*Size:* Holotype, length 1.44 mm, height 1.10 mm; USNM 157977, length 1.47 mm, height 1.09 mm. USNM 193252, ovigerous female, length 1.47 mm, height 1.06 mm. BIOGAS I, DS-14: 2 adult females without eggs, length 1.46 mm, height 1.04 mm, length 1.40 mm, height 1.07 mm.

*First Antenna* (Figure 55*e*): 1st joint with medial hairs. 2nd joint with lateral and dorsal spines and 2 spinous bristles (1 dorsal, 1 lateral). 3rd joint with well-defined distal margin, 7 bristles (1 small, ventral, 6 spinous, dorsal), and few dorsal hairs. 4th joint with concave distal margin and 3 bristles (2 ventral, 1 dorsal). 5th joint with fairly short, stout, sensory bristle with 6 long terminal filaments; lateral surface of joint with few minute spines forming row in distal dorsal corner. 6th joint with fairly long bare medial bristle. 7th joint: a-bristle claw-like, with proximal dorsal spines; b-bristle longer than a-bristle, with 3 distal marginal filaments excluding stem; c-bristle long, with short marginal filaments (tip broken off on illustrated limb). 8th joint: d-bristle missing; e-bristle only slightly longer than b-bristle, bare with blunt tip; f-bristle bent dorsally, with 4 short marginal filaments excluding stem; g-bristle longer than f-bristle, with short marginal filaments

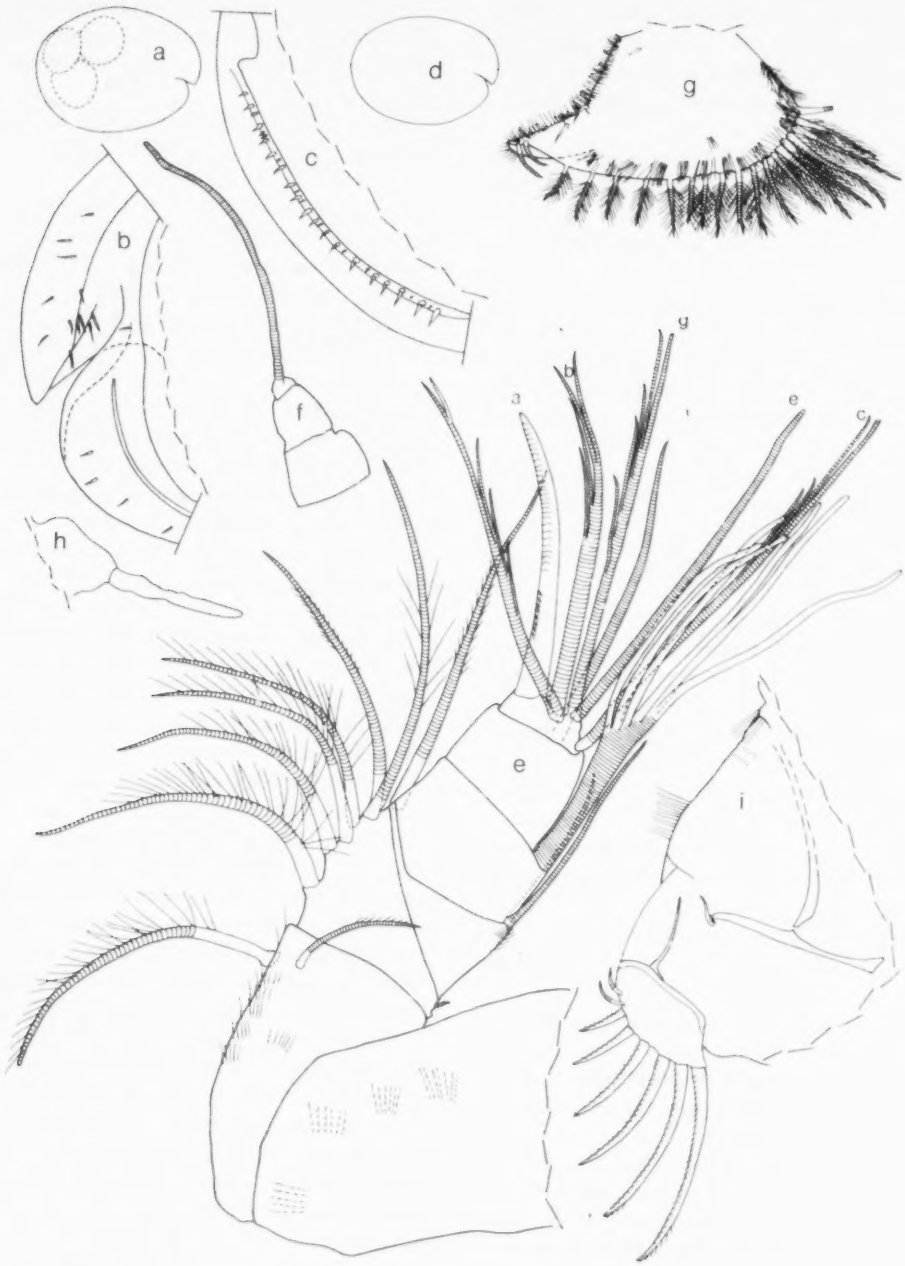


FIGURE 55.—*Parasterope antyx*, new species, ovigerous female, holotype, MNHN Os 256: *a*, complete specimen from right side showing 3 eggs in marsupium (dashed ovals) and location of central adductor muscle attachment scar (dotted oval), length 1.44 mm; *b*, anterior of right valve from inside showing bristles of infold and list; *c*, posterior of left valve from inside showing bristles of posteroventral list. Ovigerous female, paratype, USNM 157977: *d*, complete specimen from right side, length 1.47 mm; *e*, right 1st antenna, lateral view; *f*, endopodite of right 2nd antenna, medial view; *g*, right 6th limb, medial view; *h*, medial eye and Bellonci organ; *i*, posterior of body showing right lamella of furca, Y-sclerite, girdle (dashed) and spines and hairs on posterior margin.

FIGURE 56.—*Parasterope antyx*, new species, ovigerous female, USNM 157977: *a*, right mandible (coxale endite not shown), medial view; *b*, coxale endite of left mandible, medial view; *c*, left maxilla, medial view; *d*, comb of left 5th limb (ventral bristles not shown) and 6 distal bristles of epipodite, lateral view; *e*, comb of right 5th limb, lateral view; *f*, 7th limb; *g*, upper and lower lips from right side; *h*, upper and lower lips from anterior.

(tip broken off on illustrated limb).

*Second Antenna* (Figure 55*f*): Protopodite with few minute medial spines forming rows near dorsal margin and with small, distal, medial bristle. Endopodite 3-jointed: 1st and 2nd joints bare; 3rd joint well defined, with long terminal filament. Exopodite: 1st joint bare; bristle of 2nd joint just reaching 9th joint, with slender, indistinct, ventral spines; bristles of joints 3–8 with natatory hairs; 9th joint with 3 bristles (2 long with natatory hairs, 1 short, bare); basal spines absent; 9th joint with small lateral spine with few minute spines at tip; joints 2 and 3 and possibly others with indistinct minute spines forming row along distal margins.

*Mandible* (Figure 56*a,b*): Coxale endite: ventral branch with abundant slender spines along ventral margin forming rows, and tip with 2 minute spines; dorsal branch with small bristle near base of ventral branch and with 6 processes proximal to main spine of ventral margin, each process with 2 or 3 small terminal spines; tip of branch with short terminal spine; bristle on dorsal margin near tip hirsute; dorsal margin of branch opposite ventral processes with indistinct serrations. Basale: endite with 4 end bristles, 1 dwarf bristle, glandular peg, and 1 triaenid bristle with about 13 paired spines proximal to terminal pair; ventral margin without bristles; dorsal margin with 2 terminal bristles; medial surface with long slender hair-like spines; lateral surface with slender spines near ventral margin. Exopodite reaching about $^2/_3$ distance of dorsal margin of 1st endopodial joint, hirsute distally and wth 2 short subterminal bristles. 1st endopodial joint with 3 ventral bristles. 2nd endopodial joint: ventral margin with 3 terminal bristles; dorsal margin with stout a-, b-, c- and d-bristles (a-bristle bare, others with marginal spines not shown on illustrated limb); slender lateral bristle present between b- and c-bristles; dorsal margin with 1 short bristle proximal to a-bristle; 2 cleaning bristles present medial to base of b-bristle; 4 cleaning bristles forming oblique row between b- and c-bristles; 1 long bristle present just medial and distal to d-bristle; 1 long lateral bristle present between c- and d-bristles; medial surface with spines forming rows. End joint with stout terminal claw with ventral spines and 5 bristles (tip of claw missing on illustrated limb).

*Maxilla* (Figure 56*c*): Endite I with 4 bristles (3 long, 1 short); endite II with 3 long bristles. Epipodite with pointed hirsute tip reaching to about middle of dorsal margin of basale. Basale: spinous; ventral margin with 1 backward-pointing bristle near middle, 1 minute distal bristle, and 1 long hirsute terminal bristle; medial side near dorsal margin with 1 short proximal bristle; lateral side with 1 short slender proximal bristle. 1st endopodial joint spinous, with short dorsal bristle near middle and 1 long slender terminal bristle. End joint with long bare terminal bristle. (Maxilla of holotype and USNM 157977 examined.)

*Fifth Limb* (Figure 56*d,e*): Lateral side of comb with stout hirsute exopodial bristle reaching past end of comb, 2 slender bristles ventral to base of stout bristle, and 4 bristles near ventral edge of comb (1 long, 3 short).

*Sixth Limb* (Figure 55*g*): Trunk with small pointed medial bristle in proximal anterior corner; anterior with upper and lower sutures representing endites, each with short bristle; lateral flap of skirt hirsute but without bristles; anterior tip of skirt with 2 slender bristles; ventral and posteroventral margin with 18 hirsute bristles; posteroventral margin of skirt broadly curving; limb hirsute.

*Seventh Limb* (Figure 56*f*): Each limb with 12–14 bristles comprising 6 or 7 in proximal group (3 or 4 on each side) and same in distal group; longer of the bristles with 3 bells, shorter with 1 or 2 bells; terminus with 2 opposing combs, each with about 9 finger-like teeth with few indistinct spines.

*Furca* (Figure 55*i*): Each lamella with 8 claws of which posterior 2 bristle-like; right lamella slightly anterior to left.

*Bellonci Organ* (Figure 55*h*): Elongate, thinning near midlength but without well-defined suture; tip rounded.

*Eyes:* Lateral eyes absent. Medial eye bare and without pigment (Figure 55*h*).

*Upper Lip* (Figure 56*g,h*): Each lobe with 3 spines and hairs; saddle between lobes with stout anterior spine. Lower lip represented by broad rounded hirsute flap on each side of mouth.

*Posterior of Body* (Figure 55*i*): Long hairs present near midheight and near posterodorsal corner; without thumb-like dorsum. Gill-like structures poorly defined except at distal end.

*Y-Sclerite* (Figure 55*i*): Typical for subfamily.

*Eggs:* Holotype and USNM 157977, each with 5 eggs in marsupium; USNM 193252 with 6 eggs.

DESCRIPTION OF A-1 MALE (Figure 57).—Carapace similar in shape to that of adult female but not as high relative to length (Figure 57*a*).

*Size:* USNM 193253, length 1.20 mm, height 0.90 mm.

*First Antenna:* 2nd joint with dorsal spines and 2 bristles (1 dorsal, 1 lateral near dorsal margin). 3rd joint with fairly well-defined distal margin and 5 bristles (1 small, ventral, 4 spinous, dorsal). 4th joint with concave distal margin and 2 bristles (1 ventral, 1 dorsal). Sensory bristle of 5th joint with no proximal filament and 6 terminal filaments. 6th joint with long medial bristle. 7th joint: a-bristle claw-like, about same length as bristle of 6th joint, with proximal ventral spines; b-bristle slightly longer than a-bristle, with 3 distal filaments excluding stem; c-bristle long with short filaments (tip of bristle broken off on limb examined). 8th joint: d-bristle represented by minute peg with rounded tip; e-bristle about same length as b-bristle, bare with blunt tip; f-bristle bent dorsally, with short marginal filaments (tip of bristle broken off on limb examined); g-bristle similar to c-bristle (tip of bristle broken off on limb examined). a-bristle of adult appearing as inner claw almost reaching midlength of a-bristle; bristles and filaments of adult visible within limb.

*Second Antenna* (Figure 57*b*): Protopodite similar to that of adult female. Endopodite 3 jointed: 1st and 2nd joints short, bare; 3rd joint elongate with tapering tip and long proximal filament. 3rd joint of adult male endopodite visible inside 3rd

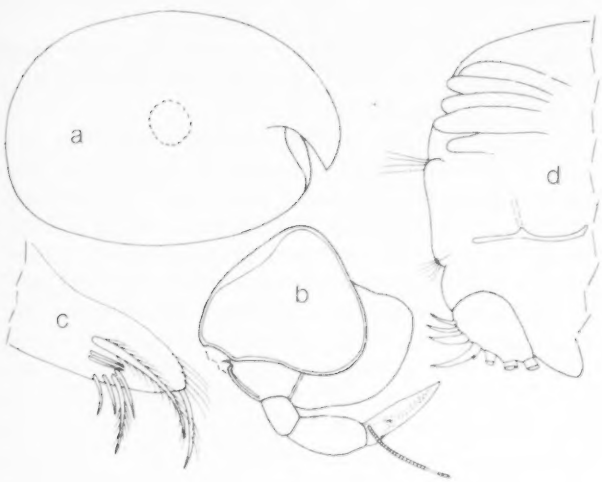


FIGURE 57.—*Parasterope antyx*, new species, A-1 male, USNM 193253: *a*, complete specimen from right side showing location of central adductor muscle attachment scars (dashed oval), length 1.20 mm; *b*, p rotopodite and endopodite of right 2nd antenna, medial view; *c*, comb of right 5th limb, lateral view; *d*, posterior of body showing gills, Y-sclerite, right lamella of furca, and spines and hairs on posterior margin.

joint. Exopodite similar to that of adult female.

*Mandible:* Ventral branch of coxale endite with slender spines forming 4 or 5 oblique rows. 2nd endopodial joint with 1 cleaning bristle medial to base of b-bristle, and 3 cleaning bristles forming row between b- and c-bristles. Limb otherwise similar to that of adult female. Claw of end joint of adult male appearing inside claw of A-1 male and reaching about 1/3 its length.

*Maxilla:* Proximal dorsal bristle and proximal lateral bristle, both of basale, not observed. Minute distal bristle on ventral margin of basale also not observed. Limb otherwise similar to that of adult female.

*Fifth Limb* (Figure 57*c*): Similar to that of adult.

*Sixth Limb:* Similar to that of adult female except for having only 14 or 15 posteroventral bristles on the skirt.

*Seventh Limb:* With 8 bristles, 4 in proximal group, 2 on each side, and same in distal group: bristles tapering distally and with 1 or 2 bells. Terminus tapering to narrow tip with opposing combs, each with few thumb-like bare teeth.

*Furca* (Figure 57*d*): Each lamella with 7 claws; claws 6 and 7 bristle-like.

*Eyes:* Lateral eyes absent.

*Upper Lip, Posterior of Body* (Figure 57*d*), *Y-Sclerite* (Figure 57*d*): Similar to those of adult female.

COMPARISONS.—Few species of *Parasterope* are without lateral eyes. The new species *P. antyx* differs from *P. annomata* Kornicker, 1975a:427 in not having a distal bristle on the dorsal margin of the basale of the maxilla and in not having bristles on the infold between the posteroventral list and valve edge. *Parasterope antyx* seems closely related to *P. longungues* Poulsen, 1965:382, but differs in being much smaller, in having 2 endite bristles on the trunk of the 6th limb, and in having fewer flap-like bristles on the broad list of the posteroventral infold. *Parasterope antyx* differs from *P. styx* Kornicker, 1975a:432 in having only 2 anterior bristles on the trunk of the 6th limb.

REMARKS.—Poulsen (1965:382) based *P. longungues* on a single specimen thought to be a not fully mature female (Poulsen, 1965:387). The presence of eggs in the ovaries of the specimen indicates that it is not younger than the next-to-last stage. He (p. 385) stated concerning the 6th limb: "the anterior margin has no endite bristles (juvenile character?)." Particularly because of this, I examined a juvenile male (described above) at the next-to-last stage of development (age determination based on its appendages having visible within them the appendages of the adult male). The 6th limb of the specimen has 2 endite bristles. This supports the conclusion herein that *P. longungues* and *P. antyx* are not conspecific. Comparison of 6th limbs of a juvenile male and female at the same stage of development is permissible because juvenile 6th limbs in the Cylindroleberidinae have little sexual dimorphism.

### *Synasterope* Kornicker, 1975

*Synasterope* Poulsen, 1965:401 [nomen nudum].—Kornicker, 1975a:440.

TYPE SPECIES.—*Synasterope implumis* Poulsen, 1965 (designation by Kornicker, 1975a:440).

DISTRIBUTION.—Members of this genus are widespread between latitudes of about 43°N to 73°S and depths of 1–4450

### Key to Species of *Synasterope* in This Study

1. Maxilla with 5 proximal bristles on ventral margin of basale . . . . . ***S. phalanx***
   Maxilla with 1 proximal bristle on ventral margin of basale . . . . . 2
2. 6th limb with more than 1 bristle dorsal to upper suture of anterior margin . . . . . ***S. hirpex***
   6th limb with 1 bristle dorsal to upper suture of anterior margin . . . . . 3
3. 7th limb with 12 or 13 bristles . . . . . ***S. helix***
   7th limb with 18 or 19 bristles . . . . . ***S. index***

m (Kornicker and Caraion, 1974:23; Kornicker, 1974, fig. 4). The known depth range in and west of the Bay of Biscay is 2147–2906 m. The known northern limit is extended slightly to about 47.5°N.

COMPOSITION.—Four species were collected in the Bay of Biscay, all new: *Synasterope phalanx*, *S. hirpex*, *S. helix*, and *S. index*.

### *Synasterope phalanx*, new species

FIGURES 58, 59

*Synasterope* species C.—Kornicker, 1985:410, 411.

ETYMOLOGY.—From the Latin and Greek *phalanx* (line, battle-array, round piece of wood, bone of the finger or toe).

HOLOTYPE.—Adult male in alcohol (undissected), MNHN Os 271, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS III, R.V. *Jean Charcot*, west of Bay of Biscay, 47°32′42″N, 8°36′30″W, 2147 m, sta 1, sample DS-36, 19 Apr 1973.

PARATYPES.—Sample DS-36 (same sample as holotype): 1 adult male on slide and in alcohol (USNM 193344); 1 adult male on slide and in alcohol (USNM 193261).

DISTRIBUTION.—West of Bay of Biscay, 2147 m.

REMARKS.—It is not possible to separate the genus *Synasterope* from the genus *Prionotoleberis* when only the adult male of a species is known. I have referred the species described herein to *Synasterope* rather than *Prionotoleberis* because it resembles closely two known species of *Synasterope*, and because species of that genus seem to be more numerous. When females or late instars are known it may be necessary to refer the species to a different genus.

DESCRIPTION OF ADULT MALE (Figures 58, 59).—Carapace elongate, with overhanging rostrum and deep broad incisur (Figure 58*a*,*f*); height decreasing posterior to midlength. Long bristles forming row near posterior end of each valve (Figure 58*f*).

*Infold* (Figure 58*a*,*b*): Rostral infold with about 70 long and 10 small bristles; narrow infold just anterior to anterior junction with 10 small bristles forming row; 3 minute bristles forming row at inner edge of infold posterior to incisur; broad anteroventral infold with about 4 long and small bristles; ventral infold between broad anteroventral infold and infold opposite anterior end of broad posteroventral list with about 28 bristles forming row; narrow list starting from anteroventral infold continues close to ventral edge of valve and broadens along posteroventral and posterior infolds; broad posteroventral-posterior infold with 24 flap-like bristles and 23 short bristles (not more than 1 short bristle between a pair of flap-like bristles); dorsal half of posterior infold of both valves with 4 small processes forming row near valve edge; posteroventral part of infold with 7 bristles forming row between broad list and edge of valve (these bristles continuation of bristles forming row along ventral infold); right valve only with small bristle just posterior to posterior juncture.

*Selvage* (Figure 58*a*): Narrow selvage with marginal hairs along lower margin of incisur, bare elsewhere.

*Size:* Holotype, length 2.14 mm, height 1.07 mm; USNM 103344, length 2.30 mm, height 1.10 mm; USNM 193261, length 2.13 mm, height 1.22.

*First Antenna* (Figure 59*a*): 1st joint bare. 2nd joint spinous, with 2 bristles (1 dorsal, 1 lateral). 3rd joint trapezoidal with 1 small ventral bristle and 6 spinous dorsal bristles. 4th joint with 2 small ventral bristles and 1 long dorsal bristle. 5th joint short with convex distal margin; sensory bristle with abundant filaments (not shown on illustrated limb). 6th joint with 2 indentations on ventral and dorsal margins; distal indentation on ventral margin location of arcuate suture extending to joint midheight, and place of attachment for inner muscles; medial bristle of 6th joint spinous, reaching well past tip of a-bristle of 7th joint. 7th joint: a-bristle with base on pedistal, claw-like, with faint ventral teeth near tip (not shown on illustrated limb); b-bristle about 3 times length of a-bristle, with 5 marginal filaments (2 short and proximal, 3 long and distal); c-bristle very long, about 3 times length of stem, with about 25 short marginal filaments. 8th joint: d-bristle absent; e-bristle about twice length of a-bristle, bare with blunt tip; f-bristle similar to c-bristle, with about 25 short marginal filaments; g-bristle much longer than b-bristle, with about 8 marginal filaments.

*Second Antenna* (Figure 58*g*): Prodopodite with small slender distomedial bristle and without spines. Endopodite 3-jointed: 1st joint elongate bare; 2nd joint elongate, with 3 short distal bristles; 3rd joint elongate, reflexed on 2nd, with long proximal filament. Exopodite: 1st joint elongate, about 3 times length of 2nd joint; 2nd joint about 3/4 combined lengths of joints 3–9; bristle of 2nd joint long, reaching well past 9th joint, with natatory hairs, no spines; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 3 bristles (2 long, 1 short), all with natatory hairs; joints 2–8 with long hairs forming row along distal dorsal margin; some joints also with few minutes spines forming row; basal spines and lateral spine of 9th joint absent.

*Mandible* (Figure 58*c*,*h*): Coxale endite: small medial bristle at base of ventral branch; ventral branch with few proximal hairs followed by spines forming 4 oblique rows; tip of branch with 3 minute teeth; ventral margin of dorsal branch with 4 small pointed processes followed by 2 low backward pointing processes; small main spine with spines along posterior edge; tip of branch with small hirsute bristle; posterior bristle hirsute, with base close to base of terminal bristle; edge of branch between main spine and tip and posterior edge near tip unusual in having long hairs (hairs between main spine and tip in place of short spines generally present in most species of the subfamily). Basale endite with 4 end bristles, 3 triaenid bristles with slender hair-like paired spines (spines of terminal pair stouter than others), 2 dwarf bristles (distal slightly longer), and glandular peg. Basale: medial side near ventral

FIGURE 58.—*Synasterope phalanx*, new species, adult male, paratype, USNM 193261, length 2.13 mm: *a*, anterior of left valve from inside showing bristles of infold and short fringed lamellar prolongation of selvage; *b*, posterior of left valve showing 4 processes between list and valve margin (bristles of list not shown); *c*, coxale endite of left mandible, medial view; *d*, comb of left 5th limb, medial view; *e*, left 6th limb, medial view. Adult male, paratype, USNM 193344: *f*, complete specimen showing c- and f-bristles of 1st antenna, length 2.30 mm; *g*, endopodite of 2nd antenna; *h*, left mandible (coxale endite not shown), medial view; *i*, left maxilla, medial view; *j*, medial eye and Bellonci organ; *k*, upper and lower lips, anterior towards left.

margin with small bare bristle near base of endite and proximal to U-shaped depression; dorsal margin with spinous bristle at midlength, and 2 long terminal bristles; medial and lateral surface of joint without spines. Exopodite hirsute, tip reaching to midlength of dorsal margin of 1st endopodial joint, with 2 small terminal bristles. 1st endopodial joint with 3 long stout spinous bristles. 2nd endopodial joint: ventral margin with 3 long, spinous, terminal bristles; dorsal margin with 3 proximal

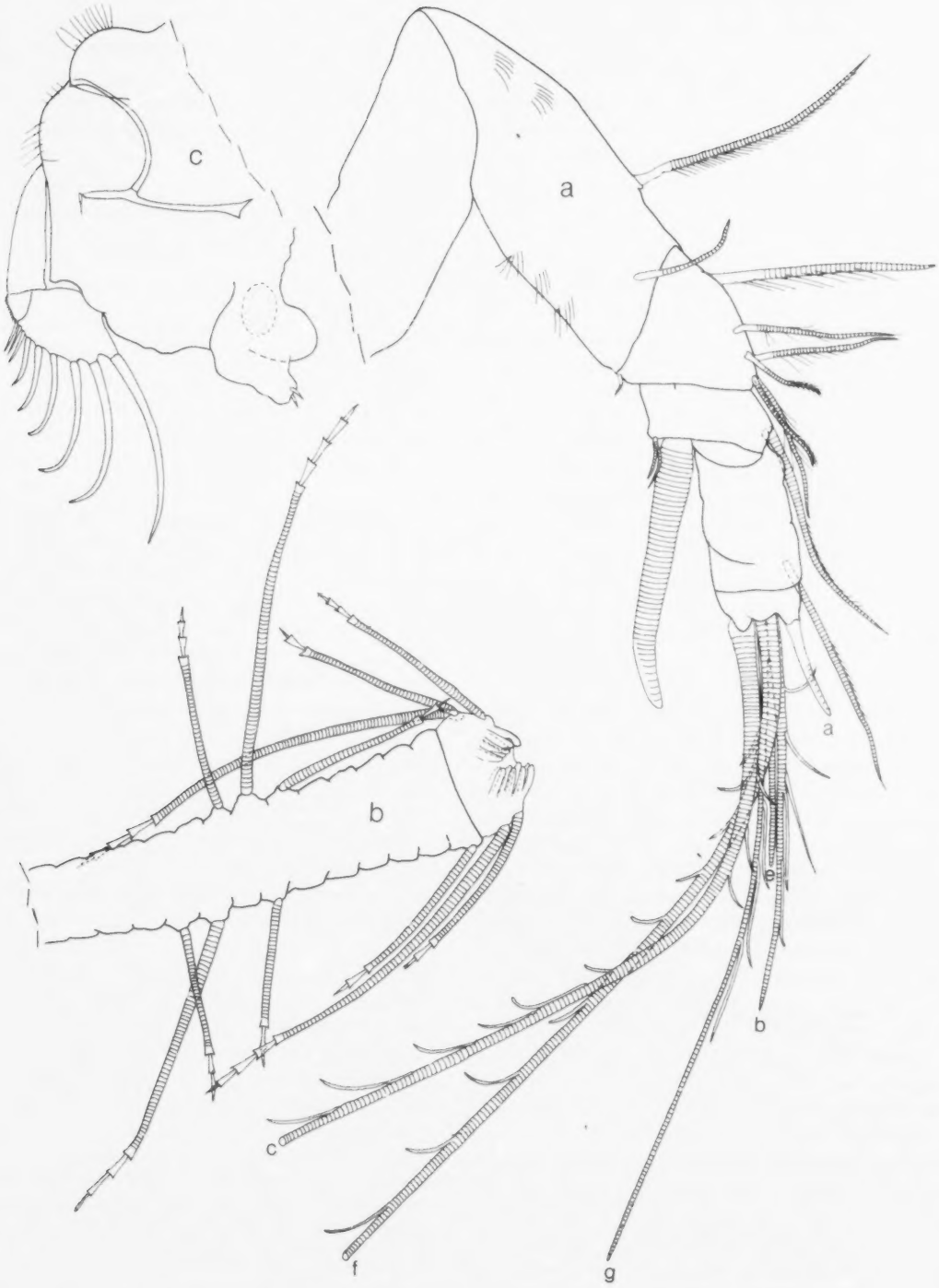


FIGURE 59.—*Synasterope phalanx*, new species, adult male, paratype, USNM 193344: *a*, right 1st antenna, lateral view; *b*, 7th limb; *c*, posterior of body showing right lamella of furca, copulatory organ, Y-sclerite and girdle, and spines and hairs on posterior margin (gills not shown).

bristles and stout spinous a-, b-, c-, and d-bristles; medial surface spinous, with 1 cleaning bristles between a- and b-bristles, 2 cleaning bristles between b-and c-bristles, 6 cleaning bristles forming oblique row between c- and d-ristles, and 1 long spinous bristle just distal to d-bristle; lateral surface with long bristle between c- and d-bristles but none between b- and c-bristles. End joint with stout dorsal claw and 5 spinous bristles.

*Maxilla* (Figure 58*i*): Epipodite with hirsute pointed tip not reaching midlength of dorsal margin of basale (not shown on illustrated limb). Endite I with 4 bristles (3 long, 1 short); endite II with 3 long bristles. Basale: medial side near dorsal margin with 1 small proximal and 1 small distal bristle; ventral margin with 5 closely spaced proximal bristles, 1 small distal bristle (on lateral side), and 1 long spinous terminal bristle; lateral side with 1 small proximal bristle. Endopodite: 1st joint with small anterior bristle and long spinous beta-bristle; end joint with long terminal bristle.

*Fifth Limb* (Figure 58*d*): Lateral side of comb with stout exopodial bristle raching past end of comb, 2 slender bristles just ventral to base of comb, 2 pairs of bristles near ventral margin of comb, 1 bristle near proximal pair but closer to ventral margin, 1 proximal and 2 distal bristles near ventral margin of comb. (Only terminal of ventral bristles shown on figure 58*d*.)

*Sixth Limb* (Figure 58*e*): Anterodorsal corner with small pointed medial bristle; anterior margin of trunk with upper and lower endites, each with 1 bristle; lateral flap with 2 bristles; skirt with 5 bristles at anterior corner, 9 or 10 short bristles along ventral margin followed by space, then 5 longer bristles along rounded posteroventral corner; limb hirsute.

*Seventh Limb* (Figure 59*b*): Each limb with 12 bristles, 6 in proximal group (3 on each side) and 6 in terminal group (3 on each side); each bristle with 2–4 bells. Terminus with opposing combs, each with about 10 spinous teeth (spines not shown on illustrated limb).

*Furca* (Figure 59*c*): Each lamella with 9 or 10 claws; posterior 2 claws bristle-like; last claw oriented ventrally (rarely posteriorly); teeth along posterior margins of claws 1–7 or 8 very small and slender with few longer than others; no spines observed along anterior margins of claws; claw 1 of right lamella anterior to claw 1 of left lamella; small spinous process followed by small spines present on short span of lamella following claws.

*Bellonci Organ* (Figure 58*j*): Elongate with suture near middle and rounded tip.

*Eyes:* Medial eye bare and without pigment. Lateral eyes absent.

*Upper Lip* (Figure 58*k*): Each lobe with 2 or 3 anterior spines; saddle between lobes with anterior spine. Lower lip represented by hirsute lateral flap on each side of mouth.

*Genitalia* (Figure 59*c*): Small lobes with few minute bristles.

*Posterior of Body* (Figure 59*c*): Segment ventral to posterior end of girdle with indistinct hairs; posterodorsal corner evenly rounded, with indistinct hairs.

Y-*Sclerite* (Figure 59*c*): Typical for subfamily.

*Gill-like Structures:* Well developed.

COMPARISONS.—Only 2 previously described species of *Synasterope* have 5 proximal bristles on the ventral margin of the basale of the maxilla: *S. polythrix* Kornicker, 1975a:454, and *S. duplex* Kornicker, 1975a:448. The new species *S. phalanx* differs from *S. polythrix* in having 12 instead of 18–22 bristles on the 7th limb, and from *S. duplex* in having a bare instead of a triaenid bristle near the base of the basale endite of the mandible. The coxale endite of the mandible of *S. phalanx* differs from those of both species in having hairs along the ventral and dorsal edges of the dorsal branch distal to the main spine. *S. duplex* is known only from the male whereas the 2 other species are known from the female; the characters selected for comparison probably are not affected by sex.

### *Synasterope hirpex*, new species

FIGURES 60–63

*Synasterope* species A.—Kornicker, 1985:410–412.

*Parasterope* species B.—Kornicker, 1985:410–412 [part, only specimen from sample DS-55].

ETYMOLOGY.—From the Latin *hirpex* (rake, harrow).

HOLOTYPE.—Adult female, length 1.50, in alcohol, MNHN Os 258, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS VI, R.V. *Jean Charcot*, west of Bay of Biscay, 46°31′12″N, 10°23′48″W, 4706 m, sta 4, sample DS-78, 25 Oct 1974.

PARATYPES.—BIOGAS IV, R.V. *Jean Charcot*, sta 3: sample DS-55, 1 A-1 male (length 1.36 mm, height 0.74 mm). BIOGAS V, R.V. *Cryos*, sta 4: sample DS-68, 1 juvenile male (USNM 193258). BIOGAS VI, R.V. *Jean Charcot*, sta 4: sample DS-78, 1 adult female on slide and in alcohol (USNM 193256); sample DS-79, 1 adult male on slide and in alcohol (USNM 193257).

DISTRIBUTION.—West of Bay of Biscay, 4125–4715 m.

DESCRIPTION OF ADULT FEMALE (Figures 60, 61).—Carapace elongate in lateral view with subparallel ventral and dorsal margins; inner end of incisur near midheight (Figure 60*a*,*b*).

*Infold* (Figure 60*b*): Anterodorsal infold including rostrum with about 120 long and short bristles (Figure 60*b*); a single bristle at inner end of incisur; broad part of anteroventral infold ventral to incisur with about 40 short and long bristles; ventral infold between broad anteroventral infold and anterior end of broad posteroventral list with about 27 bristles. Broad posteroventral list with 17 flap-like bristles and 13 small bristles (not more than 1 bristle between each pair of flap-like bristles); 1 or 2 bristles present between ventral end of broad posteroventral list and valve edge; right valve only with small bristle near posterior juncture just dorsal to end of broad

posteroventral list.

*Selvage:* Broad lamellar prolongation (with long fringe) along inner half of lower margin of incisur. Short segment with long fringe present near posterior juncture just anterior to single bristle on right valve. Elsewhere lamellar prolongation narrow and without marginal fringe.

*Size:* Holotype, length 1.50 mm, height 0.90; USNM 193256, length 1.57 mm, height 0.88 mm.

*First Antenna* (Figure 60*c*): 1st joint with medial and lateral spines and hairs. 2nd joint with medial, lateral, and ventral spines and 1 spinous dorsal bristle. Suture between 3rd and 4th joints distinct on lateral side but on medial side distinct only in ventral third; 3rd joint with small bare slender ventral bristle and 6 dorsal bristles forming 5 groups of 1, 1, 1, 1, and 2 bristles; lateral bristle of distal pair with short marginal spines, others with long proximal and short distal spines. 4th joint with long spinous dorsal bristle and 2 ventral bristles (1 long, spinous, 1 very short, bare). Distal dorsal corner of 5th joint with spines forming lateral row extending onto dorsal margin; sensory bristle with stout proximal part and 6 distal filaments. 6th joint with long medial bristle with short marginal spines. 7th joint: a-bristle claw-like, with minute distal teeth along ventral margin; b-bristle longer than a-bristle, with 3 distal filaments excluding stem, some with marginal spines; c-bristle long, with 5 marginal filaments. 8th joint: d-bristle absent; e-bristle about same length as b-bristle, bare with blunt tip; minute lateral pore present on small pedistal forming base for e-bristle; f-bristle bent dorsally, with 4 short marginal filaments; filaments of f-bristle and stem between 3rd and 4th filaments with short marginal spines.

*Second Antenna* (Figure 60*d*): Protopodite with medial spines forming rows, and very small distal medial bristle. Endopodite with 3 well-defined joints; terminal filament slightly longer than stem. Exopodite: 1st joint with long hairs forming distal rows, but with no distal medial bristle or spine; 2nd joint about twice length of 3rd; bristle of 2nd joint reaching to about 9th joint, with densely spaced hair-like spines along ventral margin; bristles of joints 3–8 with natatory hairs, but no spines; 9th joint with 1 long bristle with natatory hairs, 1 bristle about same length as combined length of joints 6–9 and with short, faint, marginal hairs, and 1 short bristle about same length as combined length of joints 8 and 9 and either bare or with indistinct, short, marginal spines ; 2nd joint with minute spines forming 2 rows; 1 near distal end and 1 just distal to midlength; joints 3–8 with minute spines forming distal row; basal spines absent; spines forming row in place of lateral spine of 9th joint.

*Mandible* (Figure 60*e,f*): Coxale endite: ventral branch with spines forming 3 oblique rows and terminal end with 3 minute teeth; small medial bristle near base of branch; ventral margin of dorsal branch with 4 paired processes followed by 4 single processes and main spine; dorsal margin of branch serrate opposite processes on ventral margin; terminal end of branch missing on both endites of specimen examined; medial surface of coxale proximal to endite with numerous spines forming rows. Basale endite with 4 end bristles, glandular peg, 2 dwarf bristles, and 2 triaenid bristles (proximal with about 15 paired marginal spines). Basale: dorsal margin with short bare midbristle and 2 long terminal bristles with short marginal spines; ventral margin with U-shaped depression but no bristles; medial surface without spines. Exopodite hirsute distally, with 2 small subterminal bristles not quite reaching distal end of dorsal margin of 1st endopodial joint. 1st endopodial joint with 3 spinous ventral bristles. 2nd endopodial joint: ventral margin with 3 long spinous terminal bristles; dorsal margin with small proximal bristle and 4 stout spinous a-, b-, c-, and d-bristles; medial surface with spines forming rows, 1 cleaning bristle between a- and b-bristles and between b- and c-bristles, 4 cleaning bristles forming oblique row near base of c-bristle, and 1 long spinous bristle with base distal to d-bristle; lateral side without bristle between b- and c-bristles and with long spinous bristle between c- and d-bristles. End joint with stout terminal claw (with proximal spines on ventral margin, and widely separated spines on dorsal margin) and 5 bristles.

*Maxilla* (Figure 61*a*): Endite I with 4 bristles (3 long, 1 short); endite II with 3 long bristles. Basale: hirsute; lateral side with 1 small proximal bristle; medial side near dorsal margin with 1 short proximal bristle and 1 longer distal bristle; ventral margin with 1 proximal bristle, 1 small distal bristle, and 1 long spinous terminal bristle. 1st endopodial joint with small anterior bristle and long terminal bristle; end joint with long terminal bristle extending past terminal bristle of 1st joint. Epipodite broken off both limbs of specimen examined.

*Fifth Limb* (Figure 61*b*): Comb: exopodial bristle extending past tip of comb; 1 slender bristle just ventral to base of exopodial bristle and 5 bristles near ventral margin of comb.

*Sixth Limb* (Figure 61*c*): Trunk with small medial bristle in proximal anterior corner; anterior margin with no bristle at lower suture and 4 bristles just dorsal to proximal suture. Skirt with 4 small bristles at anterior end and 12 hirsute bristles along ventral and posteroventral margin; lateral flap with hairs but no bristles. Limb hirsute.

*Seventh Limb* (Figure 61*d*): Proximal group with 7 bristles (3 or 4 on each side); distal group with 6 bristles (3 on each side); all bristles with 1–4 bells. Terminus comprising 2 opposing combs, each with 3 or 4 poorly defined teeth.

*Furca* (Figure 61*e*): Each lamella with 8 claws (posterior 2 bristle-like but not oriented backwards); claw 1 of right lamella slightly anterior to claw 1 of left lamella; claws 1–4 with hairs along anterior margin (hairs especially long on claw 1); teeth along posterior margins of claws 1–6 extremely fine.

*Bellonci Organ* (Figure 60*g*): Elongate, cylindrical with rounded tip.

*Eyes* (Figure 60*g*): Lateral eyes absent. Medial eye hirsute dorsally, without pigment.

*Upper Lip* (Figure 60*g*): Lobes hirsute but without spines; saddle between lobes without spines; hirsute flap on each side

FIGURE 60.—*Synasterope hirpex*, new species, ovigerous female, paratype, USNM 193256: *a*, complete specimen from right side showing location of egg in marsupium, length 1.57 mm; *b*, anterior of right valve showing bristles of infold; *c*, right 1st antenna, medial view; *d*, endopodite of 2nd antenna; *e*, left mandible (coxale endite not shown); *f*, coxale endite of left mandible (tip broken off), medial view; *g*, anterior of body showing medial eye and Bellonci organ, and upper and lower lips.

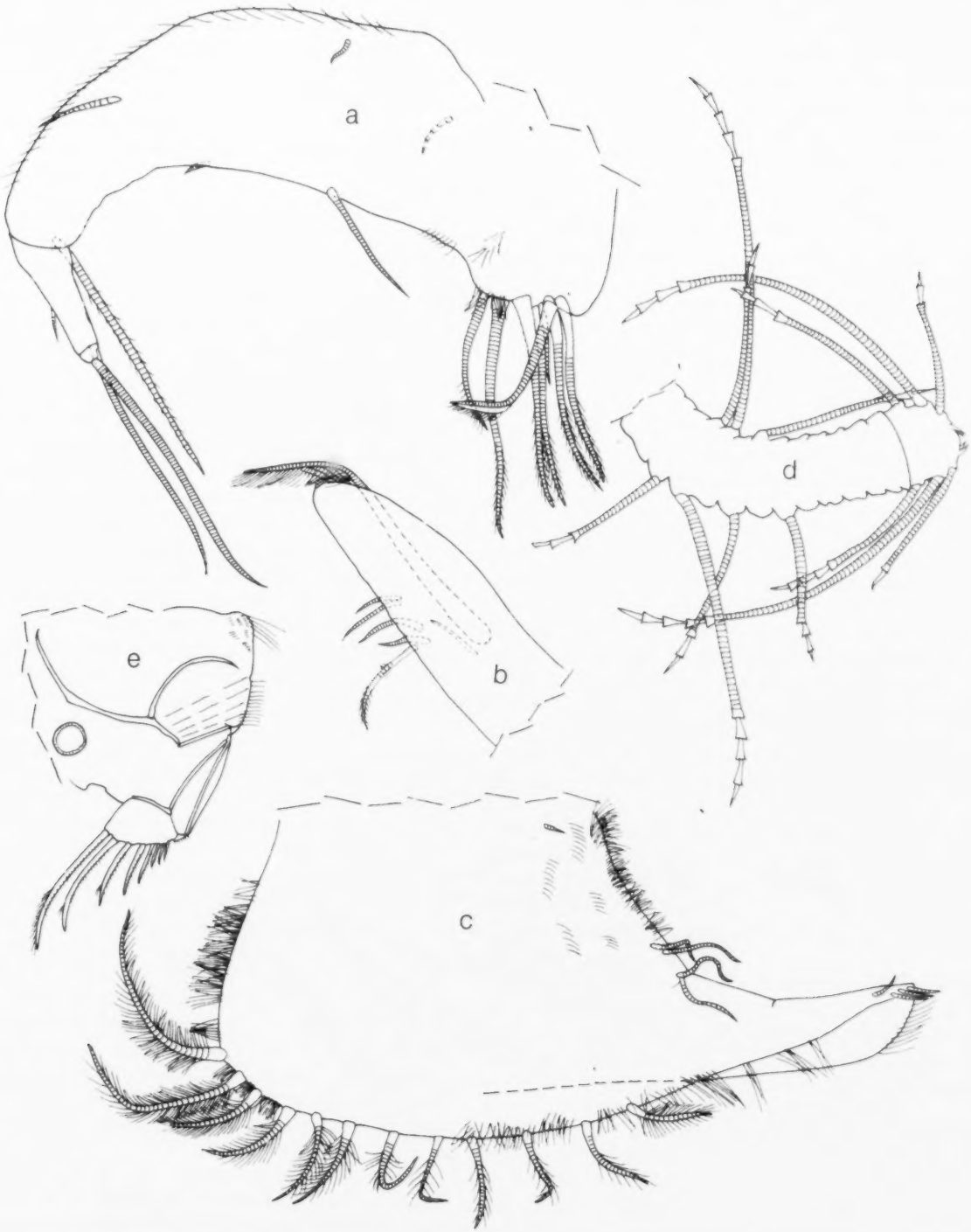


FIGURE 61.—*Synasterope hirpex*, new species, ovigerous female, paratype, USNM 193256: *a*, right maxilla (epipodite not shown), medial view; *b*, comb of right 5th limb, medial view; *c*, left 6th limb, medial view; *d*, 7th limb; *e*, posterior of body showing left lamella of furca, genital ring, Y-sclerite and girdle, and spines and hairs on posterior margin.

FIGURE 62.--*Synasterope hirpex*, new species, adult male, paratype, USNM 193257: *a*, complete specimen showing location of central adductor muscle attachment scars (dashed oval), tip of right 1st antenna with lon g c- and f-bristles, and endopodite of right 2nd antenna, length 1.80 mm; *b*, right 1st antenna (f-bristle not shown), lateral view; *c*, endopodite of left 2nd antenna, medial view; *d*, coxale endite of left mandible, medial vi ew; *e*, left mandible (coxale endite not shown), medial view; *f*, 7th limb; *g*, medial eye and Bellonci organ; *h*, copulatory organ.

of mouth.

*Posterior of Body* (Figure 61*e*): Long hairs present near midheight and at posterodorsal corner; posterodorsal corner broadly rounded and with spines forming rows.

*Genitalia* (Figure 61*e*): Oval ring on each side of body.

Y-*Sclerite* (Figure 61*e*): Typical for subfamily.

*Eggs* (Figure 60*a*): USNM 193256 with single egg in marsupium.

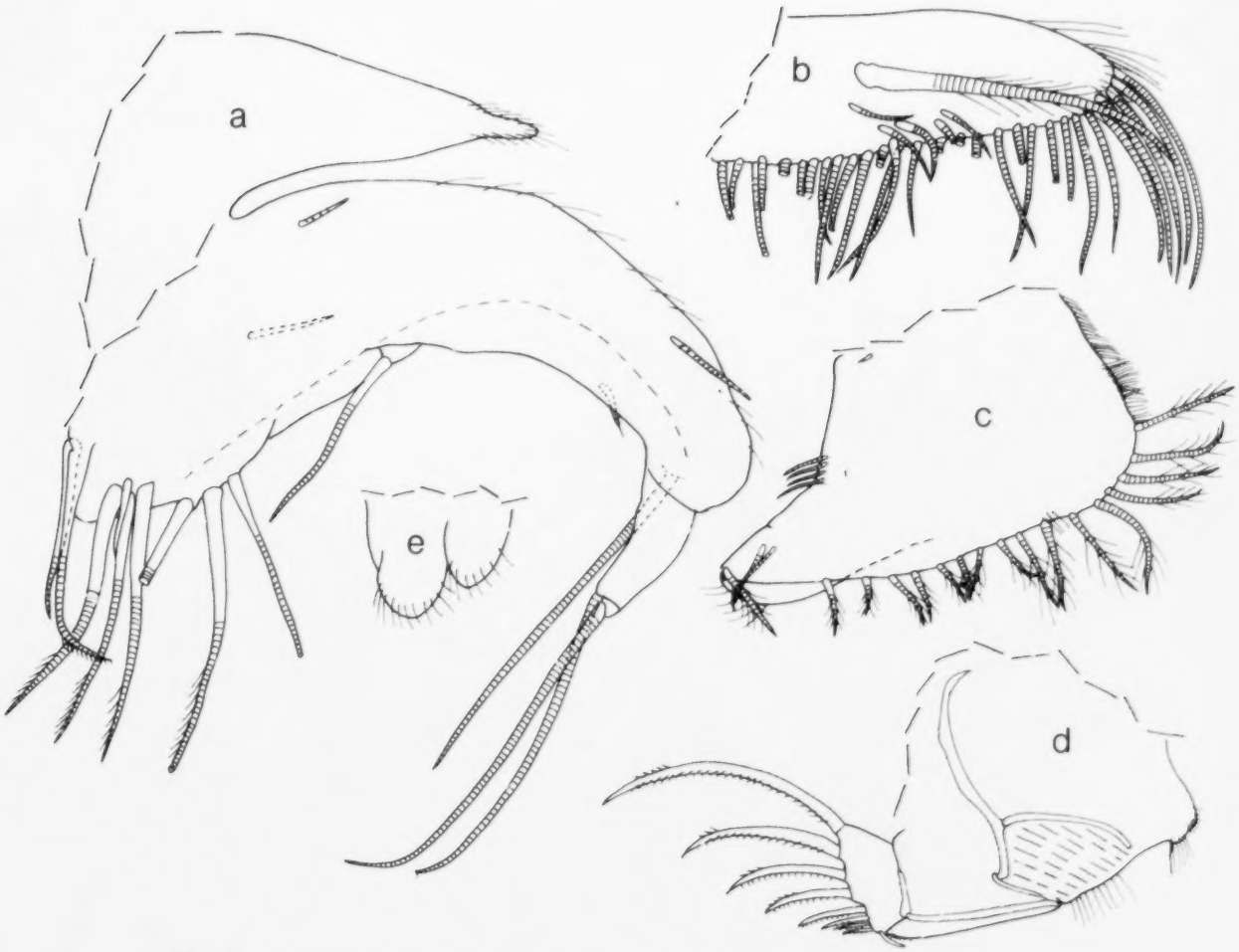


FIGURE 63.—*Synasterope hirpex*, new species, adult male, paratype, USNM 193257: *a*, left maxilla, medial view; *b*, comb of right 5th limb, lateral view; *c*, right 6th limb, medial view; *d*, posterior of body showing left lamella of furca, Y-sclerite and girdle, and spines and hairs on posterior margin; *e*, upper and lower lips, anterior towards left.

DESCRIPTION OF ADULT MALE (Figures 62, 63).—Carapace larger than that of female, with more open incisur and with narrower posterior when viewed laterally (Figure 62*a*). Hairs forming vertical row near posterior end (Figure 62*a*).

*Infold:* Not examined.

*Size:* USNM 193257, length 1.80 mm, height 0.97 mm.

*First Antenna* (Figure 62*b*): 1st joint with few medial spines forming rows. 2nd joint with medial, lateral, and ventral spines forming rows and 1 spinous dorsal bristle. 3rd joint separated from 2nd and 4th joints by sutures better defined on medial side than on lateral side; trapezoid in shape; ventral margin with small bristle; dorsal margin with 6 bristles forming 5 groups of 1, 1, 1, 1, and 2 bristles on right limb and 4 groups of 1, 1, 2, and 2 on left limb, all with long proximal spines (spines of lateral bristle of distal pair thinner than spines of medial bristle). 4th joint with 1 spinous dorsal bristle and 2 ventral bristles (medial about half length and much thinner than lateral). Sensory bristle of short 5th joint stout and with abundant filaments (filaments not shown on illustrated limb). Medial bristle of long 6th joint spinous and about same length as combined length of joints 6–8. 7th joint: a-bristle claw-like, with indistinct distal spines on ventral margin; b-bristle about 5 times length of a-bristle, with 4 marginal filaments; c-bristle very long (about 5 times length of b-bristle), with about 18 marginal filaments. 8th joint: d-bristle minute; e-bristle about twice length of a-bristle, bare with blunt tip; f-bristle similar to c-bristle (broken off on illustrated right limb but present on left limb of specimen examined); g-bristle about twice length of b-briste, with 6 marginal filaments.

*Second Antenna* (Figure 62*c*): Prodopodite with few

medial spines forming rows near ventral margin posterior to endopodite and with small medial distal bristle. Endopodite 3-jointed: 2nd joint with 3 small distal bristles; 3rd joint with proximal filament and serrate inner margin, especially near tip. Exopodite; 1st joint with distal medial spines forming rows but without terminal medial bristle. 2nd joint about same length as combined lengths of joints 3–6; bristle of 2nd joint and bristles of joints 3–8 long with natatory hairs; 9th joint with 4 bristles (3 long, 1 short), all with natatory hairs; joints 2–8 with long hairs forming distal row near inner edge and smaller hairs or spines forming medial and lateral rows along distal margins; basal spines and lateral spine of 9th joint absent.

*Mandible* (Figure 62*d*,*e*): Coxale endite: small medial bristle at base of ventral branch; ventral branch with spines forming 4 oblique rows and tip with 3 minute teeth (ventral longer than others); ventral margin of dorsal branch with 6 paired processes and 3 single processes proximal to main spine; tip of branch with slender hirsute bristle; dorsal margin of branch with hirsute bristle set back from tip of branch, and with serration opposite processes of ventral margin. Basale and 1st endopodial joint similar to those of female. Exopodite reaching to about midlength of dorsal margin of 1st endopodial joint, hirsute distally, and with 2 small terminal bristles. 2nd endopodial joint: ventral margin with 3 long spinous terminal bristles; dorsal margin with 2 short proximal bristles and stout spinous a-, b-, c-, and d-bristles; medial surface with 1 cleaning bristle between a- and b-bristles and between b- and c-bristles, 5 cleaning bristles forming oblique row near base of c-bristle, 1 long spinous bristle with base just distal to d-bristle, and spines forming rows near ventral and dorsal margins; lateral side with no bristle between b- and c-bristles, and 1 long spinous bristle between c- and d-bristles. End joint with dorsal claw with proximal spines along ventral margin and distal spines along dorsal margin, and 5 spinous bristles.

*Maxilla* (Figure 63*a*): Epipodite with narrow spinous tip reaching midlength of dorsal margin of basale. Basale and endopodite with distribution of bristles similar to that of female.

*Fifth Limb* (Figure 63*b*): Lateral bristles of comb similar to those of female.

*Sixth Limb* (Figure 63*c*): Anterior margin of trunk of right limb with 4 small bristles dorsal to upper suture and 2 slender bristles (anterior slightly longer and stouter than other) just ventral to lower suture; anterior tip of skirt with 1 bristle. Anterior margin of trunk of left limb with 7 small bristles dorsal to upper suture and 2 bristles (anterior stouter and longer) just dorsal to lower suture; anterior tip of skirt without bristle. Both limbs with medial bristle in proximal anterior corner of trunk and 16 posteroventral bristles on skirt.

*Seventh Limb* (Figure 62*f*): Proximal group with 6 or 7 bristles (3 or 4 on each side); distal group with 6 bristles (3 on each side); each bristle with 2 or 3 bells. Terminus with opposing combs, each with 2 or 3 minute curved teeth.

*Furca* (Figure 63*d*): Right lamella with 8 claws, left with 9 (9th claw bent backwards); except for 9th claw of left lamella, all claws with posterior teeth; claw 1 of right lamella anterior to claw 1 of left.

*Bellonci Organ and Medial Eye* (Figure 62*g*): Similar to those of female. Lateral eyes absent.

*Upper Lip* (Figure 63*e*), *Posterior of Body and* Y-*Sclerite* (Figure 63*d*): Similar to those of female.

*Genitalia* (Figure 62*h*): Comprising 2 lobes: outer lobe with 3 small terminal bristles.

COMPARISONS.— The presence of 4 or more bristles dorsal to the upper suture on the anterior margin of the 6th limb separates *S. hirpex* from previously described species of the genus.

### *Synasterope helix*, new species

FIGURES 64, 65

*Synasterope* species B.—Kornicker, 1985 410–412 [part, excluding specimen from sample DS-57 referred to *Synasterope index*, herein].

ETYMOLOGY.—From the Latin *helix* (coil or spiral).

HOLOTYPE.—Adult female, length 1.92 mm, on slide and in alcohol, MNHN Os 270, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS I, R.V. *La Perle*, west of Bay of Biscay, 47°33′42″N, 8°39′54″W, 2165 m, sta 1, sample DS-13, 9 Aug 1972.

PARATYPES.—BIOGAS IV, R.V. *Jean Charcot*, sta 6: sample DS-51, 1 A-1 female (USNM 193259).

DISTRIBUTION.—In and west of Bay of Biscay, 2165–2430 m.

DESCRIPTION OF ADULT FEMALE (Figure 64).—Carapace elongate with parallel ventral and dorsal margins, evenly rounded anterior and posterior margins, and incisur below valve midheight (Figure 64*a*).

*Infold* (Figure 64*b*): Broad posteroventral list with about 19 flap-like bristles and about 16 small slender bristles (not more than 1 small bristle between adjacent flap-like bristles); 6 slender bristles forming row between ventral part of posteroventral list and valve margin; 3 indistinct processes present near outer edge of valve, all below midheight of valve and dorsal to slender bristles between list and valve margin (Figure 64*b*). Infolds of rostrum and anteroventral margin with relatively few bristles (similar to infolds of A-1 female shown in Figure 65b).

*Size:* Holotype, length 1.92 mm, height 0.98 mm; height 51% of length.

*First Antenna* (Figure 64*c*): 1st joint with medial and lateral spines. 2nd joint broadening distally, with medial, lateral, and dorsal spines, 1 spinous dorsal bristle, and 1 short spinous lateral bristle. 3rd and 4th joint forming square; suture separating 3rd and 4th joints better developed in ventral half; 3rd joint with 1 small ventral bristle, and 6 dorsal bristles, all with long proximal and short distal spines. 4th joint with 2 ventral and 1 dorsal bristles. 5th joint: lateral side with spines

FIGURE 64.—*Synasterope helix*, new species, ovigerous female, holotype, MNHN Os 270: *a*, complete specimens from right side, length 1.92 mm; *b*, posterior of left valve from inside showing bristles of 1 ist and 3 processes between list and valve margin; *c*, right 1st antenna, lateral view; *d*, endopodite of left 2nd antenna, medial view; *e*, left mandible (coxale endite not shown), medial view; *f*, 7th limb; *g*, posterior of body showing right lamella of furca with 6 proximal claws, sclerotized Y-sclerite and girdle; *h*, medial eye and Bellonci organ; *i*, upper and lower lips, anterior towards left (right lobe of upper lip striate ); *j*, dorsal branch of coxale endite of mandible.

forming distal row near and extending onto dorsal margin; sensory bristle with very stout proximal part and 6 terminal filaments; length of ventral margin of 6th joint 90–100% of distance between base of sensory bristle and base of proximal filament of sensory bristle. 6th joint: medial bristle spinous, reaching tip of a-bristle of 7th joint. 7th joint: a-bristle claw-like, with few minute ventral teeth near tip; b-bristle about 1/3 longer than a-bristle, with 4 marginal filaments excluding stem; c-bristle long and with 5 short marginal filaments (tip of bristle broken off on illustrated limb). 8th joint: d-bristle represented by minute peg; e-bristle slightly shorter than b-bristle, bare with blunt tip; small lateral pore present on pedestal at base of d- and e-bristles; f-bristle bent dorsally, with 3 proximal pectinate filaments and 1 smaller distal bare filament; g-bristle long, with 6 marginal filaments.

*Second Antenna* (Figure 64*d*): Protopodite with small medial bristle and with spines forming rows on medial surface and along dorsal margin. Endopodite 3-jointed; joints well defined; end joint with long terminal filament. Exopodite: 1st joint with long medial hairs forming distal row, and without distomedial bristle; bristle of 2nd joint reaching 8th joint and with abundant slender spines along ventral margin; joints 3–8 and 2 long bristles of 9th joint with natatory hairs; short bristle of 9th joint with short marginal spines; bristle of 3rd joint with few faint spines along ventral margin; joints 3–8 with spines forming row along distal margin; 9th joint with few spines in place of lateral spine; basal spines absent.

*Mandible* (Figure 64*e*): Coxale endite broken off both limbs of holotype; coxale with spines on medial surface. Basale endite with 4 spinous end bristles, 2 dwarf bristles (proximal about half length of distal), and 3 triaenid bristles with 5 or 6 pairs of marginal spines excluding terminal pair, and a glandular peg; 1 small triaenid bristle (with 4 slender pairs of marginal spines excluding terminal pair) on basale near base of endite and proximal to U-shaped depression on ventral margin; dorsal margin with 1 spinous, backward pointing midbristle and 2 long, subterminal, spinous bristles. Stem of exopodite about 3/4 length of dorsal margin of 1st endopodial joint, hirsute distally and with 2 small terminal bristles not quite reaching distal end of joint. 1st endopodial joint with 3 long spinous bristles. 2nd endopodial joint: ventral margin with 3 long spinous terminal bristles; dorsal margin with 1 or 2 short proximal bristles and stout spinous a-, b-, c-, and d-bristles; medial side with 1 or 2 cleaning bristles between a-and b-bristles, 1 cleaning bristle between b- and c-bristles, 4 cleaning bristles forming oblique row near base of c-bristle, 1 long spinous bristle with base just distal to base of d-bristle, and spines forming rows; lateral side with 1 long spinous bristle between c- and d-bristle, and no bristle between b- and c-bristles. End joint with short straight claw with few ventral teeth near midlength, 1 short spinous medial bristle, and 4 long spinous bristles.

*Maxilla:* Endite I with 4 bristles (3 long, 1 short); endite II with 3 long bristles; 1 small spine-like bristle present on ventral margin of limb between endites but closer to endite II; long hairs present near endites. Basale: lateral side with 1 short proximal bristle near midheight; ventral margin with 1 fairly long, proximal, backward pointing bristle, 1 small distal bristle and 1 long, spinous, terminal bristle; dorsal margin with 1 short distal bristle with base on medial surface (usual proximal bristle not observed on single limb examined); surface of basale spinous. 1st endopodial joint with small, distal, anterior bristle and long beta-bristle; end joint with long, stout,terminal bristle.

*Fifth Limb:* Lost on specimen examined.

*Sixth Limb:* Trunk with 1 small spine-like medial bristle in proximal anterior corner and 1 upper and lower bristle on well-defined endites of anterior margin (upper bristle about 3/4 length of fairly long lower bristle). Skirt with 1 slender hirsute bristle on edge of lateral flap, 5 spinous bristles at anterior tip, and more than 16 bristles along posteroventral margin (part of both limbs missing on holotype; posteroventral margin originally had probably about 20 bristles); limb hirsute.

*Seventh Limb* (Figure 64*f*): Proximal group with 6 or 7 bristles (3 or 4 on each side); distal groups each with 6 bristles, 3 on each side, each bristle with 2–4 bells. Terminus with opposing combs, each with 8–10 spinous teeth.

*Furca* (Figure 64*g*): Each lamella with 8 or 9 claws; posterior claw oriented dorsally on left lamella of holotype but not on right; posterior 2 claws bristle-like.

*Bellonci Organ* (Figure 64*h*): Elongate with rounded tip.

*Eyes:* Medial eye bare, unpigmented (Figure 64*h*). Lateral eyes absent.

*Upper Lip* (Figure 64*i*): Upper lip with small anterior spine on small protuberance of left and right lobes, and small anterior spine on saddle between lobes.

*Gill-like Structures:* With 7 well-developed structures on each side.

*Eggs:* Holotype with large unextruded eggs.

DESCRIPTION OF JUVENILE (A-1) FEMALE (Figure 65).—Carapace similar in shape to that of adult female except slightly higher relative to length.

*Infold* (Figure 65*a*): Infolds of rostrum and anteroventral margin with relatively few bristles (Figure 65*a*); Broad posteroventral list and posterior infold with bristles and processes similar to those of adult female.

*Size:* USNM 193259, length 1.53 mm, height 0.83 mm; height 54% of length.

*First Antenna:* Joints 1–3 similar to those of adult female. 4th joint similar to that of adult female except ventral margin of left limb only with 3rd small terminal bristle. Sensory bristle of 5th joint similar to that of adult female except length of ventral margin of 6th joint only 82% of distance between base of sensory bristle and base of proximal filament of sensory bristle. Bristle of 6th joint reaching past tip of a-bristle of 7th joint. Bristles of 7th joint similar to those of adult female. 8th joint: d-bristle represented by minute peg; e-bristle slightly longer than b-bristle of 7th joint; f- and g-bristles similar to those of adult female.

FIGURE 65.—*Synasterope helix*, new species, A-1 instar, paratype, USNM 193259: *a*, complete specimen from left side, length 1.53 mm; *b*, anterior of right valve from inside showing bristles of infold; *c*, ventral branch of coxale endite of right mandible, medial view; *d*, right maxilla, medial view; *e*, comb of right 5th limb, medial view (ventral bristles not shown); *f*, right 6th limb, medial view; *g*, rig ht lamella of furca; *h*, posterior of body showing gills, spines on rounded dorsum, left Y-sclerite and girdle, and furca (not all claws shown; claw 1 of right lamella striate); *i*, medial eye and Bellonci organ; *j*, *k*, upper lip from right and left sides, respectively.

*Second Antenna:* Similar to that of adult female.

*Mandible* (Figure 65*c*): Coxale endite: dorsal branch broken off both mandibles of USNM 193259; ventral branch with spines forming 4 oblique rows and with 2 terminal teeth (Figure 65*c*); minute medial bristle present near base of branch. Basale endite with proximal dwarf bristle only about $^1/_3$ length of distal dwarf bristle, otherwise similar to that of adult female. Exopodite and 1st endopodial joint similar to those of adult

female. 2nd endopodial joint with 1 cleaning bristle between a- and b-bristles on both limbs, otherwise similar to that of adult female. End joint similar to that of adult female.

*Maxilla* (Figure 65*d*): Epipodite with pointed and hirsute tip reaching almost to midlength of dorsal margin of basale. Medial side of basale with 2 bristles (1 proximal, 1 distal) near dorsal margin, limb otherwise similar to that of adult female.

*Fifth Limb* (Figure 65*e*): Lateral side of comb with spinous exopodial bristle reaching well past edge of comb, 1 slender bristle just ventral to base of stout bristle, and 5 bristles closer to ventral margin of comb.

*Sixth Limb* (Figure 65*f*): Anterior tip of skirt with 4 spinous bristles, limb otherwise similar to that of adult female.

*Seventh Limb:* Similar to that of adult female except bristles having greater taper and bearing 1–3 bells. Terminus with opposing combs with spinous teeth (number of teeth obscure on USNM 193259, but seemingly fewer than on adult female). Both limbs of USNM 193259 with 6 (3 + 3) bristles in proximal group.

*Furca* (Figure 65*g,h*): Each lamella with 8 claws; posterior claw oriented dorsally on right lamella but not on left (opposite to that of adult female indicating variability within species); posterior 2 claws bristle-like; claw 1 of right lamella anterior of that of left lamella.

*Bellonci Organ* (Figure 65*i*): Elongate with suture proximal to midlength and rounded tip.

*Eyes:* Similar to those of adult female.

*Upper Lip* (Figure 65*j,k*): Right and left lobes with 1 or 2 small anterior spines on small protuberance; saddle with minute anterior spine.

*Posterior of Body* (Figure 65*h*): Posterodorsal corner evenly rounded and bearing long spines.

*Gill-like Structures:* Similar to those of adult female.

Y-*Sclerite* (Figure 65*h*): Typical for subfamily.

*Parasites:* With female choniostomatid copepod.

COMPARISONS.—The new species *S. helix* is closely related to *S. dimorpha* (Hartmann, 1965) and *S. arnaudi* Kornicker, 1975a. The basale of the mandible of the adult female of those 2 species bears a small bare ventral bristle, whereas, *S. helix* bears a triaenid bristle (bristle absent on A-1 female). The proximal part of the sensory bristle of the 1st antenna of *S. helix* is shorter and stouter than those of *S. arnaudi* and *S. dimorpha*, especially the latter.

### *Synasterope index*, new species

FIGURES 66, 67

*Synasterope* species B.—Kornicker, 1985:410–412 [part, includes only the specimen from sample DS-57; specimens from other stations referred to *Synasterope helix*, herein].

ETYMOLOGY.—From the Latin *index* (pointer or sign).

HOLOTYPE.—Juvenile male, length 2.13 mm, on slide and in alcohol, MNHN Os 269, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS IV, R.V. *Jean Charcot*, west of Bay of Biscay, 47°30′48″N, 9°07′36″W, 2906 m, sta 2, sample DS-57, 23 Feb 1974.

DISTRIBUTION.—West of Bay of Biscay, 2906 m.

DESCRIPTION OF JUVENILE MALE (A-1 or A-2)(Figures 66, 67).—Carapace elongate with subparallel ventral and dorsal margins (Figure 66*a*); anterior and posterior margins evenly rounded; inner end of incisur near midheight.

*Infold* (Figure 66*b,c*): Anterodorsal infold including rostrum with about 30 long bristles (small bristles absent); broad part of anteroventral infold ventral to incisur with about 15 long bristles (small bristles absent); ventral infold between broad anteroventral list and anterior end of broad posteroventral list with about 20 bristles. Broad posteroventral list with about 30 flap-like bristles and about 30 small bristles (except for 1 pair of flap-like bristles having 3 small bristles between them, not more than 2 bristles between adjacent flap-like bristles); 9–11 bristles forming row between ventral half of broad posteroventral list and valve edge; 3 minute, indistinct processes observed between dorsal half of broad posteroventral infold and valve edge (close to edge) of right valve (processes not observed on left valve).

*Selvage:* Inner half of lower edge of incisur with fairly narrow selvage bearing long marginal hairs. Short segment with long fringe present near posterior juncture of right valve.

*Size:* Holotype, length 2.13 mm, height 1.12 mm.

*First Antenna* (Figure 66*d*): 1st joint with medial and lateral spines. 2nd joint broadening distally, with medial and lateral spines forming rows, 1 spinous dorsal bristle and no lateral bristle. 3rd and 4th joints forming square; diagonal suture separating joints better developed on lateral side; 3rd joint with small ventral bristle, and 6 dorsal bristles, all with long proximal and short distal spines. 4th joint with 2 ventral and 1 dorsal bristle. 5th joint with small lateral spines forming row near midlength and dorsal to midheight and additional spines forming row at distal end of dorsal margin (this row mainly on lateral side); sensory bristle with stout proximal part and 6 terminal filaments; length of ventral margin of 6th joint 70–80% of distance between base of sensory bristle and base of proximal filament of sensory bristle. 6th joint with lateral spines forming 2 rows near and on dorsal margin, and spinous medial bristle not reaching tip of a-bristle of 7th joint. 7th joint: a-bristle claw-like, with few minute ventral teeth near tip; b-bristle about 1/3 longer than a-bristle, with 4 marginal filaments excluding tip; c-bristle about twice length of b-bristle, with about 12 short marginal filaments. 8th joint: d-bristle absent; e-bristle slightly longer than a-bristle and shorter than b-bristle, bare with blunt tip; minute lateral pore present on small pedestal supporting e-bristle; f-bristle about same length as c-bristle, bent dorsally, with about 13 small marginal filaments; marginal spines present on distal part of stem; g-bristle about same length as c-bristle, with about 10 short marginal filaments.

*Second Antenna* (Figure 66*e*): Protopodite with small medial bristle and abundant medial spines forming rows on

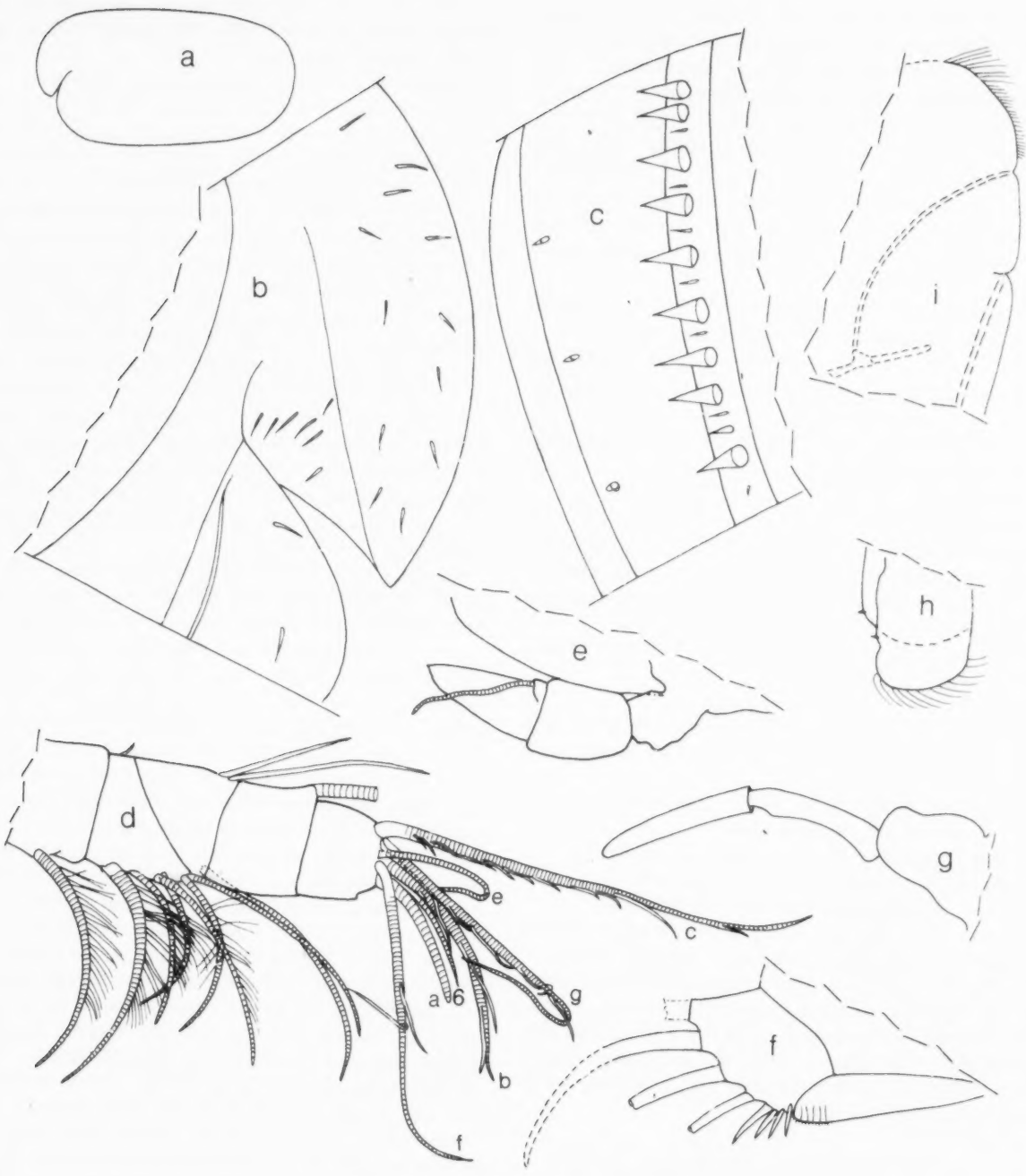


FIGURE 66.—*Synasterope index*, new species, A-1 or A-2 male, holotype, MNHN Os 269: *a*, complete specimen from left side, length 2.13 mm; *b*, anterior of left valve from inside showing bristles of infol d; *c*, part of caudal of left valve from inside showing bristles of list and 3 processes between list and valve margin; *d*, joints 2–8 of right 1st antenna (only proximal part of sensory bristle of 5th joint shown), lateral view; *e*, endopodite of left 2nd antenna, medial view; *f*, left lamella of furca; *g*, medial eye and Bellonci organ; *h*, upper lip from left side; *i*, posterior of body showing spines along dorsum and part of Y-sclerite and girdle.

FIGURE 67.—*Synasterope index*, new species, A-1 or A-2 male, holotype, MNHN Os 269: *a–d*, right mandible, medial view: *a*, coxale endite; *b*, detail of tip of dorsal branch of *a*; *c*, detail of ventral branch in *a*; *d*, limb with coxale endite not shown. *e*, comb of right 5th limb (ventral bristles not shown), medial view; *f*, 7th limb.

dorsal half. Endopodite 3-jointed with well-defined sutures; 3rd joint tapering to small nipple with spine at tip, and long proximal filament. Exopodite: 1st joint with long hairs on distal dorsal margin, and without distomedial bristle; bristle of 2nd joint reaching just past 9th joint and with ventral spines; bristles of joints 3–8 with natatory hairs, no spines; 9th joint with 3 long bristles with natatory hairs and 1 small bristle with few small marginal spines; joints 2–5 with spines forming row along distal margin (spines numerous only on joints 2 and 3); joints 2–8 with few spines at distal ventral corner but without basal spines; 9th joint with several slender spines forming row in place of lateral spine.

*Mandible* (Figure 67*a–d*): Coxale endite (Figure 67*b–d*): small bristle present near base of ventral branch; ventral branch with hairs followed by relatively few spines forming 3 oblique rows; tip with 2 slender teeth; ventral margin of dorsal branch with 2 pairs of pointed processes followed by a rounded process and then a single irregular process; main spine slender, recurved with slender teeth along the concave edge; distance between main spine and tip of branch unusually long; distal end near tip with about 6 long hairs just proximal to terminal spine; terminal spine with marginal hairs; dorsal margin of branch serrate distally; subterminal bristle reaching well past terminal spine and with marginal hairs; hairs present on margin

proximal to subterminal bristle. Basale endite with 4 end bristles, 3 triaenid bristles (with 3 pairs of slender spines followed by 5–8 pairs of stouter spines proximal to terminal pair), 2 dwarf bristles (proximal about 1/3 length of distal), and prominent glandular peg. Basale: ventral margin with small triaenid bristle (with 7 pairs of slender spines proximal to terminal pair) proximal to U-shaped depression; dorsal margin with 1 short, bare, backward pointing midbristle, and 2 long terminal bristles with short marginal spines; medial surface of basale without spines. Exopodite fairly short, hirsute tip reaching to midlength of dorsal margin of 1st endopodial joint, with 2 short terminal bristles reaching just past midlength of margin. 1st endopodial joint with 3 long, spinous, ventral bristles. 2nd endopodial joint: ventral margin with 3 long, spinous, terminal bristles; dorsal margin with 1 short proximal bristle and stout, spinous, a-, b-, c-, and d-bristles; medial surface with spines forming rows, 1 cleaning bristle between b- and c-bristles, 4 cleaning bristles forming oblique row near base of c-bristle, and 1 long spinous bristle just distal to base of d-bristle; lateral surface with 1 long spinous bristle between c- and d-bristles but none between b- and c-bristles. End joint with short, straight, bare, dorsal claw and 5 bristles.

*Maxilla:* Epipodite hirsute, short, not reaching midlength of dorsal margin of basale. Endite I with 4 bristles (3 long, 1 short); endite II with 3 long bristles. Basale: lateral side with 1 short proximal bristle at about midheight; medial side with 1 very small proximal bristle bristle at about midheight, and 1 longer distal bristle near dorsal margin; ventral margin with 1 backward pointing proximal bristle and 1 long spinous terminal bristle. 1st endopodial joint with small anterior bristle near midlength and a long bare beta-bristle. End joint with 1 long bare terminal bristle reaching slightly past beta-bristle.

*Fifth Limb* (Figure 67*e*): Lateral side of comb with long, stout, spinous exopodial bristle, 1 slender bristle just ventral to base of stout bristle and 5 slender bristles closer to ventral margin.

*Sixth Limb:* Trunk with 1 small spine-like medial bristle in proximal anterior corner and 1 upper and lower bristle on well-defined endites of anterior margin (upper bristle about 60% of fairly long lower bristle). Skirt with 1 or 2 slender hirsute bristles on edge of lateral flap, 4 or 5 spinous bristles at anterior tip, and 18 bristles along posteroventral margin; limb hirsute.

*Seventh Limb* (Figure 67*f*): Bristles not separated into proximal and distal groups; each limb with 18 or 19 bristles, each with 1–3 bells; bristles with fairly strong taper (juvenile character). Terminus with opposing combs, each with 8 or 9 spinous teeth.

*Furca* (Figure 66*f*): Each lamella with 8 claws; posterior 2 claws bristle-like, but none oriented dorsally; claw 1 of right lamella slightly anterior to claw 1 of left lamella.

*Bellonci Organ* (Figure 66*g*): Elongate with suture near midlength; tip rounded.

*Eyes:* Medial eye bare and without pigment (Figure 66*g*). Lateral eyes absent.

*Upper Lip* (Figure 66*h*): Each lobe and saddle between lobes with small anterior spine.

*Posterior of Body* (Figure 66*i*): Posterodorsal margin of body spinous; spines longer at corner.

*Genitalia:* None observed.

Y-*Sclerite:* Typical for subfamily (posterior end shown in Figure 66*i*).

*Gill-like Structures:* Well developed.

*Parasites:* Holotype with cyproniscid isopod within carapace, either male or juvenile.

AGE OF HOLOTYPE.—The holotype is a juvenile male at the A-1 (instar V) or A-2 (instar IV) stage. At present the two stages are not easily separated. The relatively long 3rd joint of the endopodite of the 2nd antenna suggests that the holotype is a stage V, but the taper on the bristles of the 7th limb, and the presence of only 1 bell on 1 or 2 of the bristles does not preclude a stage IV. Appendages of the following stage are not present within the appendages of the holotype.

COMPARISONS.—Only two previous species of *Synasterope* have more than 12 or 13 bristles on the 7th limb, *S. polythrix* Kornicker, 1975a:454, and *S. mystax* Kornicker, 1975a:457. The new species, *S. index*, differs from *S. polythrix* in having only 1 proximal bristle on the ventral margin of the maxilla, and from *S. mystax* in not having a small dwarf bristle on the basale endite of the mandible close to the base of the endite (the bristle is in addition to the dwarf bristles in the usual locality near the glandular peg).

### *Prionotoleberis* Kornicker, 1974

*Prionotoleberis* Kornicker, 1974:37.

TYPE SPECIES.—*Prionotoleberis gyion* Kornicker, 1974.

DISTRIBUTION.—Members of this genus have been collected in the Gulf of Naples, Italy, at a depth of 55 m and off Mauritania at a depth of 96–338 m (Kornicker and Caraion, 1974:37). The known depth range of the genus in the Bay of Biscay is 101–1913 m.

COMPOSITION.—Two species were collected in the Bay of Biscay, *P. pax* Kornicker and Caraion, 1974:37, and *P. rex*, new species. *Prionotoleberis pax* was collected at a depth of 101 m in the 3 samples in the collection from shelf depth.

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FIGURE 68 (right).—*Prionotoleberis pax* Kornicker and Caraion, ovigerous female, USNM 158593: *a*, complete specimen from right side, length 1.61 mm; *b*, right maxilla (endite bristles not shown), medial view; *c*, posterior of body showing Y-sclerite and girdle, and left lamella of furca; *d*, medial eye and Bellonci organ; *e*, right lateral eye; *f*, anterior of body showing broad anterior projection and upper and lower lips.

### Key to Species of *Prionotoleberis* in This Study

With lateral eyes; with 6 bristles near the dorsal margin of the basale of the maxilla . . . . . ***P. pax***

Without lateral eyes; with 2 bristles near the dorsal margin of the basale of the maxilla . . . . . ***P. rex***

### *Prionotoleberis pax* Kornicker and Caraion, 1974

FIGURE 68

*Prionotoleberis pax* Kornicker and Caraion, 1974:37, figs. 19, 20.—Kornicker, 1985:410–412.

HOLOTYPE.—Ovigerous female, length 1.73 mm, on slide and in alcohol, number 264, Museum of Natural History "Grigore Antipa," Bucharest, Romania.

TYPE LOCALITY.—Eastern Atlantic off the Islamic Republic of Mauritania, 20°50′05″N, 17°39′00″W, 270 m.

MATERIAL.—BIOGAS VII, R.V. *Cryos*, sta Grande Vasiere: sample KR-128, 1 ovigerous female (USNM 158593); sample KR-131, 1 ovigerous female; sample KR-137, 1 early instar.

DISTRIBUTION.—Bay of Biscay, 101 m. Off Mauritania, 96–338 m (Kornicker and Caraion, 1974:37).

SUPPLEMENTARY DESCRIPTION OF ADULT FEMALE (Figure 68).—Carapace elongate with slightly arcuate ventral and dorsal outline and evenly rounded anterior and posterior outlines (Figure 68*a*).

*Size:* USNM 158593, length 1.61 mm, height 0.73 mm; specimen from sample KR-131, length 1.62 mm, height 0.86 mm.

*First Antenna:* Combined 3rd and 4th joints slightly wider

than long (not the reverse as stated in Kornicker and Caraion, 1974:39); ventral margin of 4th joint with short spines forming 2 rows (at midlength and subterminal). 7th joint: a-bristle claw-like with lateral and medial teeth in proximal part oriented dorsally and few faint ventral teeth near tip; b-bristle about 1/3 longer than a-bristle, with 1 short proximal filament and 3 longer distal filaments excluding stem; c-bristle about twice length of a-bristle, with 5 marginal filaments followed by 1 very short marginal filament and filament-like tip. 8th joint: d-bristle represented by minute spine-like bristle; e-bristle slightly longer than a-bristle but shorter than b-bristle, bare with blunt tip; minute lateral pore present on pedestal supporting d- and e-bristles; f-bristle slightly longer than b-bristle, bent dorsally and with 4 filaments (with marginal spines) followed by 1 distal marginal filament and filament-like tip; g-bristle about same length as c-bristle, with 5 filaments followed by 1 very short marginal filament and filament-like tip.

*Second Antenna:* Exopodial bristles on joints 2–5 with ventral spines, bristle of remaining joints with only natatory hairs; bristle of 2nd joint without dorsal hairs.

*Mandible:* 2nd endopodial joint with 1 cleaning bristle between a- and b-bristles, 2 or 3 cleaning bristles forming row between b- and c-bristles, and 5 or 6 cleaning bristles forming row near base of c-bristle. End joint: dorsal claw with few indistinct teeth near midlength of ventral margin.

*Maxilla* (Figure 68*b*): Epipodite with pointed not rounded tip as stated in Kornicker and Caraion (1974:39). Beta-bristle of 2nd endopodial joint about 3/4 length of terminal bristle of end joint. Right maxilla only of USNM 158593 with small distal bristle on ventral margin of basale.

*Fifth Limb:* Combs of both limbs of USNM 158593 with 1 slender bristle ventral to base of stout exopodial bristle and 2 pairs of bristles closer to ventral margin.

*Sixth Limb:* Ventral margin of skirt more convex than shown in appendage illustrated by Kornicker and Caraion (1974, fig. 20j). Lateral flap of skirt with only 1 bristle on both limbs of USNM 158593.

*Seventh Limb, Furca* (Figure 68*c*), *Bellonci Organ* (Figure 68*d*), *Eyes* (Figure 68*d,e*), *Upper lip* (Figure 68*f*): Similar to those described by Kornicker and Caraion (1974).

*Posterior of Body* (Figure 68*c*): Area ventral and dorsal to posterodorsal end of girdle spinous; dorsal corner forming broadly rounded right angle.

Y-*Sclerite* (Figure 68*c*): Typical for subfamily.

*Eggs:* USNM 158593 with 11 eggs in marsupium.

### *Prionotoleberis rex*, new species

FIGURES 69, 70

*Prionotoleberis* species A.—Kornicker, 1985:410–412.

ETYMOLOGY.—From the Latin *regis, rex* (king).

HOLOTYPE.—Adult female, length 1.79 mm, in alcohol, MNHN Os 264, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS VI, R.V. *Jean Charcot*, Gulf of Biscay, 44°05′12″N, 4°19′24″W, 1913 m, sta 6, sample DS-87, 1 Nov 1974.

PARATYPES.—BIOGAS III, R.V. *Jean Charcot*, sta 6: sample DS-49, 1 adult female on slide and in alcohol (USNM 193260).

DISTRIBUTION.—Bay of Biscay, 1845–1913 m.

DESCRIPTION OF ADULT FEMALE (Figures 69, 70).—Carapace elongate with parallel ventral and dorsal margins (Figure 69*a,b*); anterior and posterior margins evenly rounded.

*Infold* (Figure 69*c,d*): Rostral infold with numerous (about 100) bristles, mostly long and near edge of valve; broad anteroventral infold with about 50 bristles; 1 small bristle near inner end of incisur; ventral infold between broad anteroventral infold to point opposite ventral edge of broad posteroventral list with about 37 bristles forming row; narrow list with anterior end ventral to incisur, continuing along ventral infold and becoming broader at posteroventral and posterior infold where it bears about 26 flap-like bristles and about 28 small bristles (not more than 1 or 2 small bristles between each pair of flap-like bristles); 6 bristles forming row between ventral part of flap-bearing list and valve edge. Each valve with 3 small processes between dorsal half of broad posterior list and valve margin (Figure 69*d*).

*Selvage:* Selvage broad and bearing fringe along ventral margin of incisur; fringe also present in short segment near posterior juncture of right valve; selvage narrow and without fringe along anterior and ventral margins; broad selvage with smooth edge also present along anteroventral list (Figure 69*c*) and anterior half of ventral list.

*Size:* USNM 193260, length 1.78 mm, height 0.96 mm; holotype, length 1.79 mm, height 0.96 mm.

*First Antenna* (Figure 69*e*): 1st joint with spines forming rows on medial and lateral sides and along dorsal margin. 2nd joint with spines forming rows on medial and lateral sides and along ventral and dorsal margins, and with stout, spinous, subterminal, dorsal bristle, and shorter, bare, lateral bristle near dorsal margin. 3rd and 4th joints forming square and divided by a suture well defined only near ventral margin; short ventral margin of 3rd joint with minute bristle; dorsal margin with 6 spinous bristles. 4th joint with 1 spinous dorsal bristle, 2 ventral bristles, and medial spines forming distal row near dorsal margin and extending onto margin. 5th joint with distal spines forming row on dorsal margin and extending onto medial and lateral sides; additional spines forming row near midlength of dorsal margin and extending onto lateral side; sensory bristle with short proximal filament and 6 terminal filaments. 6th joint with spines forming row at midlength of dorsal margin and extending onto lateral surface; medial bristle spinous and extending past a-bristle of 7th joint. 7th joint: a-bristle claw-like, bare; b-bristle about 1/3 longer than a-bristle, with 4 marginal filaments excluding stem; c-bristle not quite

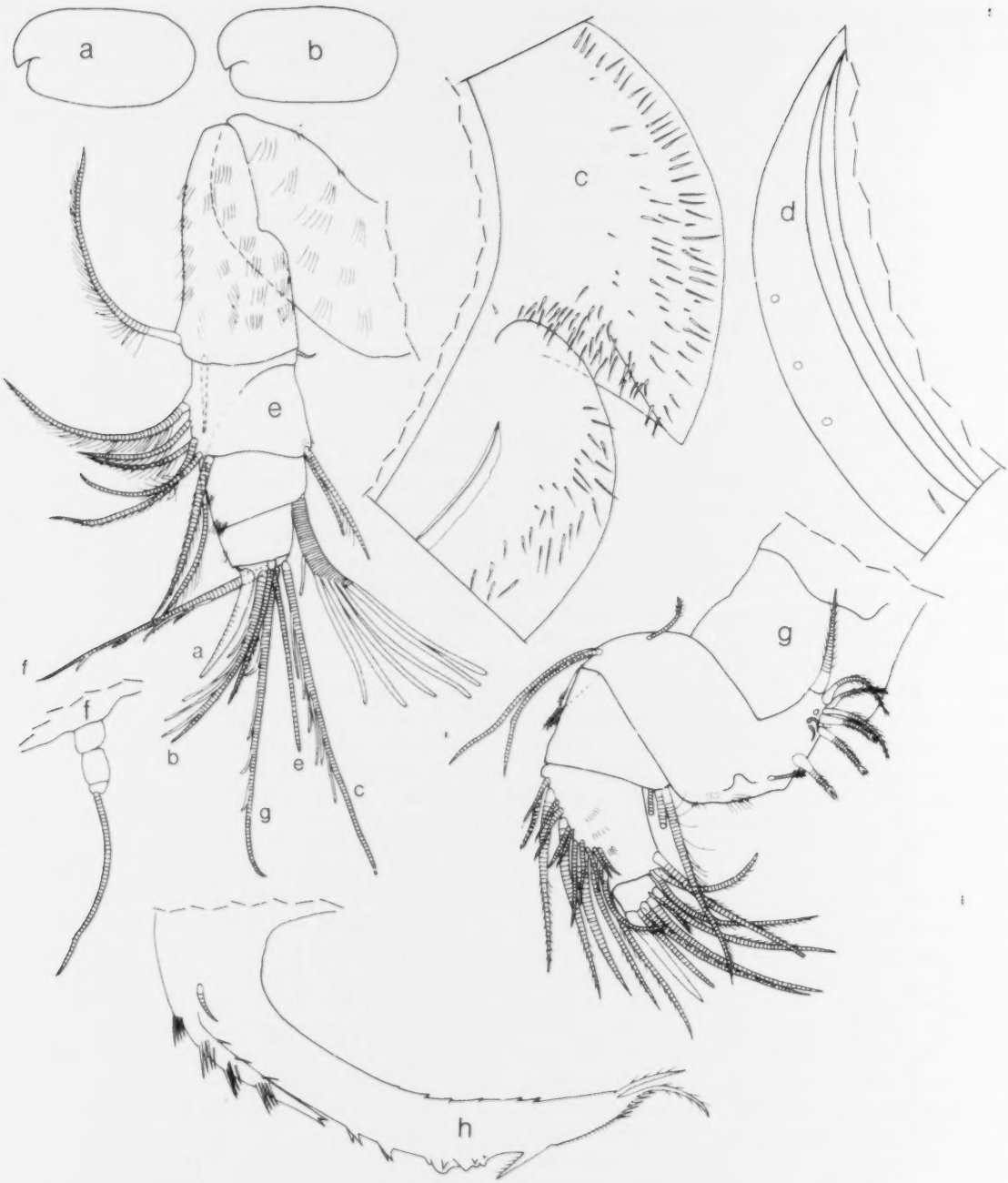



FIGURE 69.—*Prionotoleberis rex*, new species, adult female, holotype, MNHN Os 264: *a*, complete specimen from left side, length 1.79 mm. Adult female, paratype, USNM 193260: *b*, complete specimen from l eft side, length 1.78 mm; *c*, anterior of left valve from inside showing bristles of infold and lamellar prolongation along anteroventral list; *d*, posterior of left valve showing 3 processes between list and valve margin (bristles of 1st not shown); *e*, right 1st antenna, medial view; *f*, endopodite of left 2nd antenna, medial view; *g*, right mandible (coxale endite not shown), medial view; *h*, coxale endite of right mandible, medial view.

twice length of b-bristle, with 6 short marginal filaments. 8th joint: d-bristle represented by minute peg; e-bristle slightly longer than b-bristle, bare with blunt tip; f-bristle bent dorsally and longer than b-bristle but shorter than c-bristle, with 4 short marginal filaments (proximal 3 with marginal spines); g-bristle almost as long as c-bristle, with 4 short marginal filaments. (Lateral bristle of 2nd joint is actually missing on right limb of illustrated specimen; Figure 69*e*.) The dashed bristle shown is from left limb and is shown in illustration in order to indicate its closeness to dorsal margin.)

*Second Antenna* (Figure 69*f*): Protopodite with small mediodistal bristle and abundant medial spines forming rows on anterior 2/3; spines present along ventral and dorsal margins (ventral spines stouter than others); additional shorter spines forming few medial rows near posterior end at about midheight. Endopodite with 3 well-defined segments; end segment with long terminal filament. Exopodite: long 1st joint with long distal hairs forming cluster near dorsal margin; bristle of 2nd joint reaching 8th joint, with abundant ventral hair-like spines; bristles of joints 3 to 4 or 5 with few minute ventral spines; bristles of joints 3–8 with natatory hairs; 9th joint with 1 long bristle with natatory hairs, 1 short dorsal bristle with small marginal spines, and a somewhat longer bare bristle (about 2 1/2 times length of short bristle); joints 2–8 with spines forming row along distal margin but without basal spines; 9th joint with few spines in place of lateral spine.

*Mandible* (Figure 69*g,h*): Coxale endite (Figure 69*h*): ventral branch with spines forming 4 oblique rows; tip with 2 or 3 minute teeth; small medial bristle near base of branch; ventral margin of dorsal branch with 2 paired pointed spines followed by several low rounded processes with minute medial spines; main spine (slender with spines along proximal margin) some distance from tip of branch; terminal bristle hirsute, with long proximal ventral spines extending onto ventral edge of branch; dorsal margin of branch serrate and with hirsute bristle with base set back from tip of branch. Basale endite with 4 end bristles, 3 triaenid bristles with 5 pairs of stout marginal spines proximal to terminal pair and 3–6 pairs of more slender spines proximal to stouter spines, 2 small dwarf bristles (distal bristle stouter and slightly longer), and glandular peg. Basale: ventral margin near base of endite and proximal to U-shaped depression with very small triaenid bristle with 2 pairs of spines proximal to terminal pair; dorsal margin with fairly short bristle (with few distal hairs) at midlength and 2 terminal bristles; long spines present on lateral surface near ventral margin and extending onto margin; fewer spines on medial side near ventral margin; additional lateral spines near dorsal margin. Exopodite with hirsute tip reaching to about midlength of dorsal margin of 1st endopodial joint, with 2 small terminal bristles. 1st endopodial joint with 3 ventral bristles. 2nd endopodial joint: ventral margin with 3 stout spinous terminal bristles; dorsal margin with 2 small proximal bristles and stout spinous a-, b-, c-, and d-bristles; lateral surface with stout spinous bristle between c- and d-bristles but none between b-and c-bristles; medial surface with spines forming rows, 1 or 2 cleaning bristles between a- and b-bristles, 1 or 2 cleaning bristles between b- and c-bristles, 5 cleaning bristles forming oblique row between c- and d-bristles, and 1 stout spinous bristle with base just distal to d-bristle. End joint with dorsal claw with few indistinct distal dorsal teeth, and 5 bristles.

*Maxilla* (Figure 70*a*): Epipodite hirsute, tip not reaching midlength of dorsal margin of basale. Endite I with 4 bristles (3 long, 1 short); endite II with 3 long bristles. Basale spinous: medial surface near dorsal margin with 1 short proximal bristle and 1 slightly longer distal bristle; lateral surface with 1 short proximal bristle; ventral margin with 2 paired proximal bristles (only 1 bristle on illustrated left limb, but 2 on right limb of specimen, and holotype with paired bristles on both limbs), 1 minute distal bristle, and 1 long spinous terminal bristle. 1st endopodial joint with small anterior bristle and long beta-bristle. End joint with long terminal bristle slightly longer than beta-bristle of 1st joint.

*Fifth Limb* (Figure 70*b*): Lateral side of comb with 1 long stout hirsute exopodial bristle reaching past end of comb, 1 slender bristle just ventral to base of stout bristle, 2 pairs of bristles closer to ventral margin, 4 slender bristles almost on ventral margin (1 proximal, 1 just proximal to proximal paired bristles, and 2 near distal end of comb).

*Sixth Limb* (Figure 70*c*): Anterodorsal corner with small medial bristle; anterior margin of trunk with upper and lower spinous bristle at each well-defined endite suture; lower bristle slightly longer than upper. Skirt: lateral flap with 1 slender hirsute bristle; anterior end with 4 short spinous bristles; ventral and posteroventral margin with 19 or 20 hirsute bristles (posterior 3 longer); limb hirsute.

*Seventh Limb* (Figure 70*d*): Each limb with 12–15 bristles: 5 or 6 in distal group (2 or 3 on each side), 7–9 in proximal group (3–5 on each side); each bristle with 1–3 bells. Terminus with opposing combs, each with 8 spinous teeth.

*Furca* (Figure 70*e*): Each lamella with 8 claws; posterior 2 claws bristle-like; posterior claw bent dorsally; claws 1–4 with few long teeth among short teeth along concave margin; claw 1 of right lamella anterior to claw 1 of left lamella; small spinous process present posterior to lamellae.

*Bellonci Organ* (Figure 70*f*): Elongate with suture near middle and with rounded tip.

*Eyes* (Figure 70*f*): Medial eye unpigmented bare. Lateral eyes absent.

*Upper Lip* (Figure 70*f*): Each lobe with 1 or 2 minute anterior spines, and extending ventrally some distance from ventral edge of saddle separating lobes. Lower lip consisting of lateral flap on each side of mouth.

*Anterior of Body* (Figure 70*f*): USNM 199260 with anterior hirsute bulge at midheight (just ventral to base of 1st antenna) and 4 minute anterior spines between bulge and upper lip.

*Posterior of Body* (Figure 70*e*): With spines at midheight and on evenly rounded posterodorsal corner.

FIGURE 70.—*Frionotoleberis rex*, new species, adult female, holotype, MNHN Os 264: *a*, left maxilla, medial view; *b*, comb of left 5th limb (ventral bristles not shown), lateral view; *c*, right 6th limb, medial view; *d*, 7th limb; *e*, posterior of body showing medial view of left set of gills, spines of dorsum, Y-sclerite and girdle, gentital ring, anus (dashed), and right lamella of furca; *f*, anterior of body showing medial eye (dorsal hairs not shown) and Bellonci organ, anterior hirsute bulge, and upper and lower lips.

*Genitalia* (Figure 70*e*): Consisting of sclerotized ring on each side of body anterior to furca.

Y-*Sclerite* (Figure 70*e*): Typical for subfamily.

*Gill-like Structures* (Figure 70*e*): Well developed, 7 on each side of body.

*Parasites:* Holotype with female choniostomatid copepod inside carapace.

COMPARISONS.—The new species differs from *P. pax* and *P. gyion* in not having lateral eyes. The maxilla of *P. rex* differs from that of *P. pax* in having only 2 bristles rather than 6 on the dorsal margin of the basale, and from that of *P. gyion* in not having 1 or 2 small bristles on endite II and in having 2 instead of 3 dorsal bristles on the basale. The maxilla of *P. rex* differs from both species in having paired proximal bristles on the ventral margin of the basale.

### *Domromeus*, new genus

ETYMOLOGY.—The genus is named for Dom R. Rome. Gender: masculine.

TYPE SPECIES.—*Domromeus heptathrix* Kornicker, new species.

DISTRIBUTION.—Known only from in and west of the Bay of Biscay.

COMPOSITION.—The genus is proposed for the new species described herein, *Domromeus heptathrix*.

DIAGNOSIS (based only on type species).—Female carapace short, ovoid with length less than 2 mm; posterior infold without linear ridge between broad list and posterior valve margin.

*First Antenna:* Dorsal margin of 3rd joint with fewer than 6 bristles (female of *D. heptathrix* with 3 or 4 (usually 4) bristles). Sensory bristle of 5th joint with 7 terminal filaments and without small proximal filament. The d-bristle of 8th joint almost as long as e-bristle.

*Second Antenna:* Protopodite with small medial bristle. Endopodite of female 3-jointed with long terminal filament. Exopodite: with basal spines; 9th joint with 2 bristles.

*Mandible:* Ventral branch of coxale endite with 3 small teeth (inner tooth smaller than others). Basale endite with glandular peg, 4 end bristles, 2 dwarf bristles, and 2 triaenid bristles with about 9 pairs of small spines (distal pairs longer than others) excluding terminal pair; dorsal margin of female basale without midbristle. Exopodite reaching midlength of dorsal margin of 1st endopodial joint. Endopodite: 2nd joint with long lateral bristle between b- and c-bristles of dorsal margin and with relatively few (8) cleaning bristles.

*Maxilla:* 2nd endopodial joint with single terminal bristle.

*Fifth limb:* Comb with parallel ventral and dorsal margins; lateral surface with spinous exopodial bristle reaching past end of comb, 2 slender bristles just ventral to base of spinous bristle and 5 bristles near ventral margin of comb.

*Sixth Limb:* Anterior margin with 1 bristle at upper endite and without bristle at lower endite.

*Seventh Limb:* Each limb with 6 or 7 bristles; terminus with opposing combs, each with 5 spinous teeth.

*Furca:* Each lamella with 8 claws.

*Bellonci Organ:* Elongate, 1-jointed with rounded tip.

*Eyes:* Medial eye bare. Lateral eyes absent.

COMPARISONS.—The new genus is defined mainly on the female having a 1st antenna with a well-developed, filament-like, d-bristle, and 7 terminal filaments on the sensory bristle of the 5th joint. The type species, *D. heptathrix*, has only 3 or 4 dorsal bristles on the 3rd joint of the 1st antenna, but whether this is a specific or generic character is unknown at present.

Three other genera have a filament-like, well-developed d-bristle on the 1st antenna, *Archasterope* Poulsen, 1965, *Skogsbergiella* Kornicker, 1975a, and *Empoulsenia* Kornicker, 1965, but none have more than 6 terminal filaments on the sensory bristle of the 5th joint of the 1st antenna. The d-bristle of *Archasterope* is only about half the length of the e-bristle, compared to being just slightly shorter in *Domromeus*. All species of the other genera have 6 bristles on the dorsal margin of the 3rd endopodial joint of the female compared to only 3 or 4 on *D. heptathrix*. The infold of the right valve of *Domromeus* does not have a linear ridge between the list and posterior valve margin as on *Skogsbergiella*. The maxilla and the 7th limb of *Domromeus* bear fewer bristles than those limbs on species of *Empoulsenia*. Members of the genus *Bathyleberis* Kornicker, 1975, have a well-developed d-bristle, but it tapers to a point (bristle-like), and on some species bears marginal spines.

### *Domromeus heptathrix*, new species

FIGURES 71–73

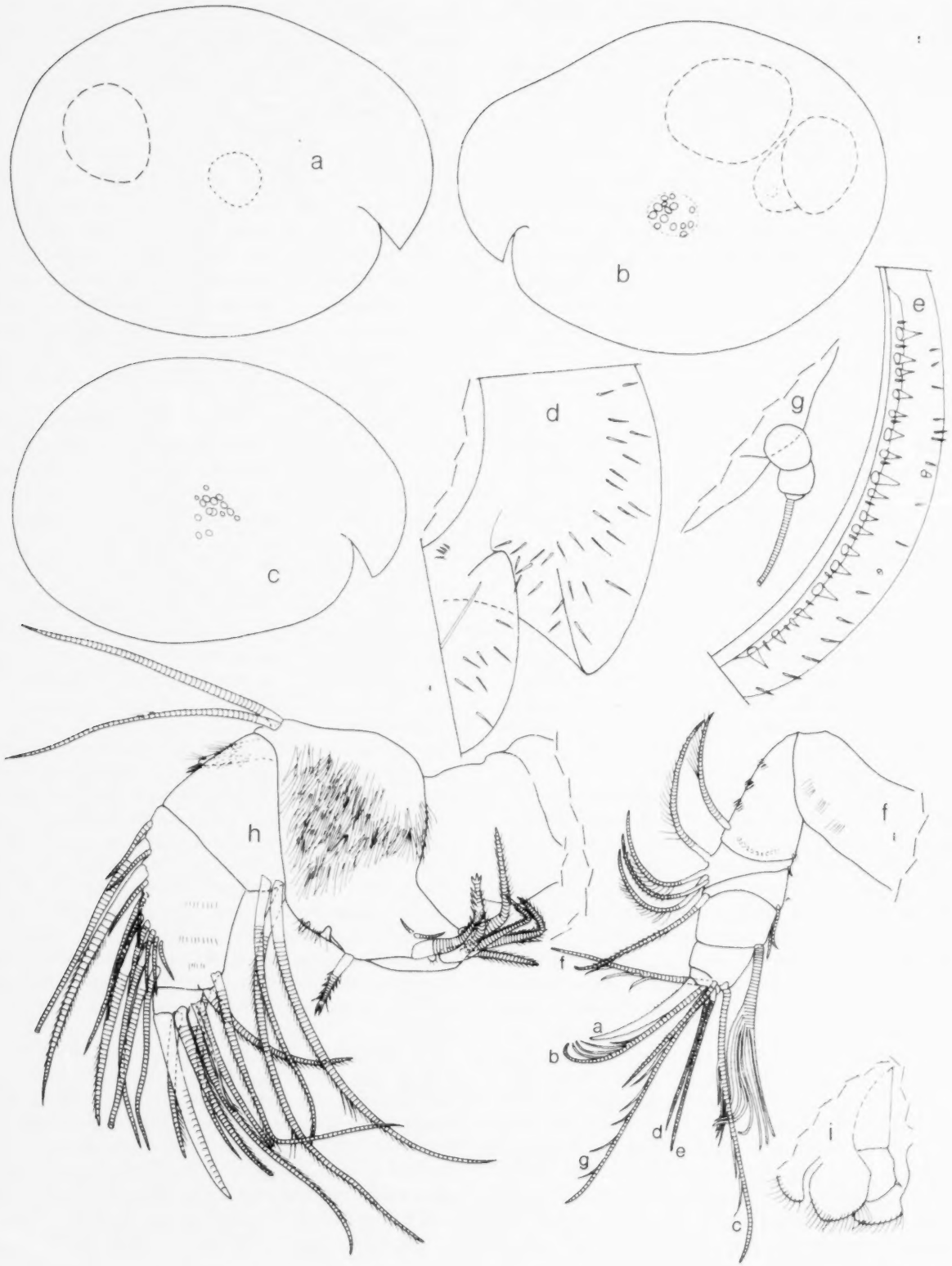
*Archasterope?* species A.—Kornicker, 1985:410–412.

ETYMOLOGY.—From the Greek *hepta* (seven), combined with *thrix* (hair), in reference to the 7 filaments on the sensory bristle of the female first antenna.

HOLOTYPE.—Ovigerous female in alcohol, MNHN Os 153, Muséum National d'Histoire Naturelle, Paris, France.

TYPE LOCALITY.—BIOGAS VIII, sta 1, sample KG-147, collected during period from 18 May to 8 June 1979, R.V.

FIGURE 71.—*Domromeus heptathrix*, new species, ovigerous female, holotype, MNHN Os 153: *a*, complete specimen from right side showing locations of large egg in marsupium and central adductor muscle attachment sc ars (smaller oval), length 1.24 mm; *b*, adult female, paratype from BIOGAS VI, sta 6, sample CP-23a, length 1.13 mm, complete specimen from left side showing some central adductor muscle attachment scars and location in marsupium of female choni ostomatid copepod (largest oval) and 2 of its eggs sacs (2 smaller ovals). Ovigerous female, paratype, USNM 157978, length 1.16 mm: *c*, complete specimen from right side showing central adductor muscle attachment scars; *d*, anterior of left valve from inside showing bristles of infold; *e*, posterior of right valve from inside showing bristles along list and bristle and 2 processes between list and valve margin; *f*, right 1st antenna, medial view; *g*, endopodi te of left 2nd antenna, medial view; *h*, right mandible (coxale endite not shown), medial view; *i*, Upper and lower lips, oblique view from right.


a
b
c
d
e
g
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i

*Noroit*, west of Bay of Biscay, 47°33′24″N, 8°40′42″W, 2190 m.

PARATYPES.—POLYGAS, R.V. *Jean Charcot*, sta 1: sample DS-15, 8 specimens (USNM 193264); sample DS-17, 2 ovigerous females (USNM 193274). BIOGAS II, R.V. *Jean Charcot*, sta 1: sample DS-32, ovigerous female (USNM 157978); sta Hors-Zone: sample DS-33, 1 adult female plus 1 juvenile female. BIOGAS III, R.V. *Jean Charcot*, sta 1: sample DS-37, 1 early instar. BIOGAS IV, R.V. *Jean Charcot*, sta 1: sample DS-63, 1 adult female. BIOGAS V, R.V. *Cryos*, sta 1: sample DS-65, 1 ovigerous female (USNM 193191). BIOGAS VI, R.V. *Jean Charcot*, sta 6: sample CP-23a, 2 adult females. BIOCYAN, R.V. *Suroit*, sta 1: sample PL-22, 1 ovigerous female (USNM 193275). Paratypes in Paris: MNHN OS 154–156.

DISTRIBUTION.—In and west of Bay of Biscay, 1980–2360 m.

DESCRIPTION OF ADULT FEMALE (Figures 71–73).— Carapace oval in lateral view with well-defined rostrum overhanging anteroventral part of carapace and forming deep incisur (Figures 71*a–c*, 72*g*).

*Infold* (Figure 71*d,e*): Infold of rostrum with 1 bristle on list, 5–8 bristles between list and incisur, and about 32 bristles anterior and dorsal to list (only lower part of rostrum shown in illustration); about 27 bristles on broad part of anteroventral infold between list and valve edge, and about 16 bristles along ventral infold to point opposite lowermost flap-like bristle on posterior list; broad posterior list with about 17 broad, transparent, flap-like bristles and about 11 small bristles (not more than 1 small bristle between a pair of transparent bristles); 2 small processes and about 14 bristles present on posterior infold between broad list and posterior margin of valve; posterior margin of valve with minute pores.

*Size:* Holotype, length 1.24 mm, height 0.96 mm. Paratypes: BIOGAS II, DS-32, USNM 157978, length 1.16 mm, height 0.88 mm; DS-33, length 1.25 mm, height 0.92 mm. BIOGAS IV, DS-63, length 1.19 mm, height 0.85 mm; USNM 193191, length 1.23 mm, height 0.94 mm. BIOGAS VI, CP-23a, length 1.13 mm, height 0.89 mm. BIOCYAN, PL-22, USNM 193275, length 1.21 mm, height 0.90 mm.

*First Antenna* (Figures 71*f*, 73*a*): 1st joint with distal medial hairs forming rows. 2nd joint with spines at distal ventral corner and along dorsal margin and 2 bristles (1 lateral, 1 dorsal). 3rd joint short with 4 or 5 bristles (1 ventral, 3 or 4 dorsal). 4th joint short with concave distal margin and 3 bristles (2 ventral, 1 dorsal). Sensory brisle of 5th joint with 7 terminal filaments. Medial bristle of 6th joint long, spinous. 7th joint: a-bristle claw-like, with indistinct proximal spines along dorsal margin; b-bristle longer than a-bristle, with 3 or 4 marginal filaments; c-bristle long, with 4 or 5 marginal filaments. 8th joint: d- and e-bristles well developed, about same length as b-bristle; d-bristle slightly smaller and much thinner than e-bristle and with minute spine at tip, e-bristle with minute tubercle at tip, both bristles with indistinct, closely spaced rings typical of filaments and unlike more widely spaced and distinct rings of bristles; f-bristle bent dorsally, with 4 marginal filaments (tip broken on illustrated specimen); g-bristle long, with 5 marginal filaments.

*Second Antenna* (Figures 71*g*, 73*b*): Protopodite with short medial bristle, and medial spines near dorsal margin. Endopodite 3-jointed; 3rd joint short and with terminal filament twice length of stem (Figure 73*b*). Exopodite: bristle of 2nd joint reaching to 5th joint, with short spines along ventral margin and without natatory hairs; bristles of joints 3–8 long, with natatory hairs; bristles of joints 3–6 also with minute, indistinct, ventral spines; 9th joint with 2 bristles (1 long with natatory hairs, 1 short with short marginal spines); joints 3–5 with small basal spines; 9th joint with small lateral spine divided into 3 cusps; joints 2–8 with short, slender spines forming row along distal margin.

*Mandible* (Figures 71*h*, 73*c,d*): Dorsal branch of coxale endite broken off both limbs of specimens examined; small bristle at base of ventral branch; ventral branch with 3 groups of spines forming oblique rows (each group with slender proximal and stout distal spines); terminus with 3 small teeth (inner tooth smaller than others). Basale: endite with 4 end-type bristles, 1 triaenid bristles, 2 dwarf bristles, and glandular peg; ventral margin with short triaenid bristle proximal to U-shaped depression and spines distal to U-shaped depression; triaenid bristles with about 6 pairs of minute proximal spines and 3 pairs of longer distal spines; dorsal margin with 2 terminal bristles with few short marginal hairs; medial surface with long hairs forming rows. Exopodite reaching midlength of 1st endopodial joint, hirsute with 2 short subterminal bristles. 1st endopodial joint with 3 spinous ventral bristles. 2nd endopodial joint: ventral margin with 3 spinous terminal bristles; dorsal margin with stout a-, b-, c-, and d-bristles and small proximal bristle; lateral surface near dorsal margin with slender bristle (shorter than a-bristle) between b- and c-bristles, and slender bristle between c- and d-bristles; medial surface near dorsal margin with small cleaning bristle near a-bristle, 2 small cleaning bristles between b-and c-bristles, 5 slender cleaning bristles forming oblique row near c-bristle, and 1 long slender bristle near d-bristle; medial surface also with indistinct hairs forming short rows. End joint with dorsal claw bearing proximal ventral teeth, and 5 bristles, most with marginal spines.

*Maxilla* (Figures 72*a*, 73*f*): Endite I with 4 bristles (3 long, 1 short); endite II with 3 long bristles. Basale: hirsute dorsal margin with 2 short bristles (1 proximal, 1 distal); ventral margin with 1 fairly long, proximal, posteriorly oriented bristle and 1 long, spinous, terminal bristle; lateral side with 1 short proximal bristle. Endopodite: 1st endopodial joint with small alpha-bristle and long bare beta-bristle; end joint with long, bare, terminal bristle. Exopodite hirsute, pointed.

*Fifth Limb* (Figures 72*b*, 73*g*): Lateral surface of comb

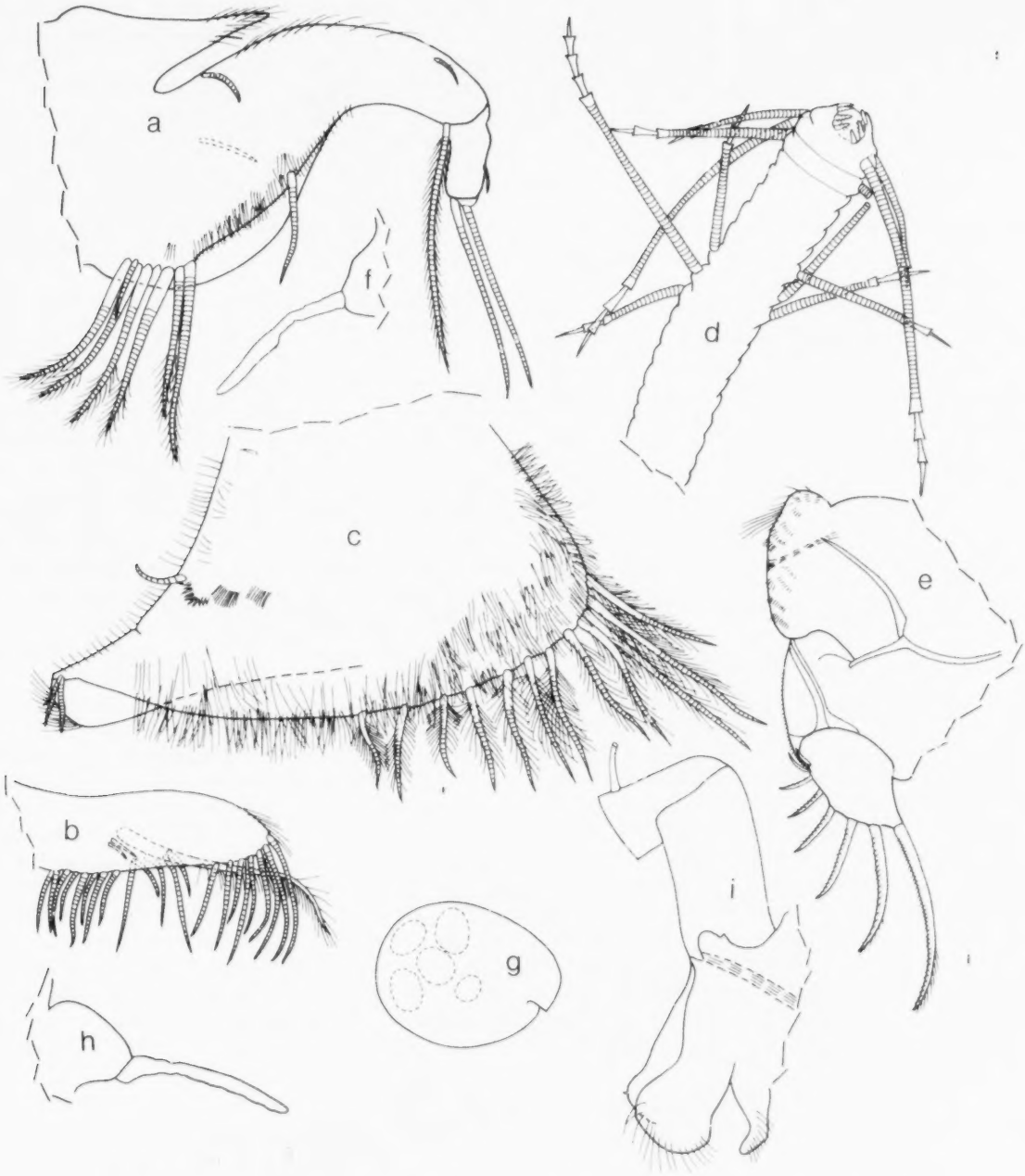


FIGURE 72.—*Domremeus heptathrix*, new species, paratype, USNM 157978: *a*, left maxilla, medial view; *b*, comb of left 5th limb, medial view; *c*, right 6th limb, medial view; *d*, 7th limb; *e*, posterior of body showing spines, Y-sclerite and girdle, and right lamella of furca. Ovigerous female, paratype, USNM 193275: *g*, complete specimen showing locations of 4 eggs in marsupium and central adductor muscle attachment scars (small anterior oval), length 1.21 mm; *h*, medial eye and Bellonci organ; *i*, anterior of body showing medial view of joints 1 and 2 of right 1st antenna, and upper and lower lips (spine on saddle).

FIGURE 73.—*Domrometis heptathrix*, new species, ovigerous female, paratype, USNM 193191, length 1.23 mm: *a*, left 1st antenna, lateral view; *b*, distal part of protopodite and endopodite of right 2nd ant enna, medial view; *c*, left mandible (coxale endite not shown), medial view; *d*, ventral branch of coxale endite of left mandible, lateral view; *e*, detail from *c* showing U-shaped depression and proximal tri aenid bristle of ventral margin of basale; *f*, left maxilla (epipodite not shown), medial view; *g*, comb or right 5th limb, medial view; *h*, left 6th limb, medial view; *i*, 7th limb.

with 2 small slender bristles at base of stout hirsute exopodial bristle and 5 bristles near ventral margin.

*Sixth Limb* (Figures 72*c*, 73*h*): Medial surface with minute bristle in anterodorsal corner; anterior margin with short bristle at upper endite and without bristle at lower endite; medial surface with about 11 spines forming crescent-like row near upper endite, and with hairs forming rows inward from anterior and ventral margins. Skirt with 3 bristles at anterior corner and 10–12 spinous bristles along posteroventral margin. Posterior margin of skirt hirsute, lateral flap with hairs and without bristles.

*Seventh Limb* (Figures 72*d*, 73*i*): Proximal group with 3 bristles (3 on each side), each with 2 or 3 bells; terminal group with 6 (rarely 7) bristles (3 or 4 on each side), each with 1–3 bells. Terminus consisting of opposing combs, each with 5 spinous linear teeth.

*Furca* (Figure 72*e*): Each lamella with 8 claws (posterior 2 bristle-like and bent backward); claws 1 and 2 with hairs along convex anterior margin; claws 1–6 with teeth along concave posterior margin (teeth mostly equilength but with few slightly longer); claws 7 and 8 with indistinct small spines along both margins; right lamella positioned anterior to left lamella; margin of lamellae posterior to claws with minute spines.

*Bellonci Organ* (Figure 72*h*): Elongate with rounded tip.

*Eyes:* Medial eye bare and without pigment (Figure 72*h*). Lateral eyes absent.

*Upper Lip* (Figure 72*i*): Comprising 2 hirsute lobes with hirsute lateral flap present on each side of mouth; saddle between lobes with minute anterior spine.

*Genitalia:* Oval sclerotized ring on each side of body anterior to furca.

*Posterior of Body* (Figure 72*e*): Dorsum consisting of broad, low, convex process bearing hairs.

*Gills:* Narrow, poorly developed.

Y-*Sclerite* (Figure 72*e*): Without ventral branch.

*Eggs* (Figures 71*a*, 72*g*): USNM 157978 with 2 eggs in marsupium; specimen from sample KG-147 with only 1 egg in marsupium; specimen from sample DS-65 with 5 eggs in marsupium; USNM 193275 with 6 eggs in marsupium.

*Parasites* (Figure 71*b*): Specimen from sample CP-23a with female choniostomatid copepod and 2 copepod ovisacs (this occurrence was mistakenly reported as a cyproniscid Isopod in Kornicker (1985:410)).

### *Archasterope* Poulsen, 1965

*Archasterope* Poulsen, 1965:339.

TYPE SPECIES.—*Archasterope dentata* Poulsen, 1965:339, by monotypy.

DISTRIBUTION.—Collected in southern oceans between 34°35′S and 55°S at bottom depths of 180–1861 m, and in a mid-water trawl dragged at a depth of 1812–2145 m (Kornicker, 1975a:383).

COMPOSITION.—The genus comprises 2 species: *A. dentata* Poulsen, 1965:339, and *A. bulla* Kornicker, 1975a:384.

### *Archasterope dentata* Poulsen, 1965

*Archasterope dentata* Poulsen, 1965:339, figs. 113, 114.

HOLOTYPE.—Female with large unextruded eggs in ovary; carapace length 1.89 mm.

TYPE LOCALITY.—Off southeast Australia, 38°12′S, 149°40′E, 180 m.

MATERIAL EXAMINED.—Through the courtesy of Dr. Torben Wolff, I received from the Copenhagen Museum the holotype and paratype (adult female) of the species. Both were in a single small vial within a larger vial containing a label with the following information: "*Archasterope dentata* n. sp., 180 m. 17-9-1914. female 1.89 mm. Mortensen leg., E.M. Poulsen det. Type." Unfortunately, the 1st antennae of both specimens were not in the vial.

DISCUSSION.—I had sent for the types of *A. dentata* in order to verify that the d-bristle is a filament, not bristle-like as in *Bathyleberis* Kornicker, 1975a:538, and that both the d- and e-bristles of the 1st antennae bear a minute terminal spine as shown in Poulsen's illustration (1965, fig. 113d,e). The absence of 1st antennae in the vial containing the holotype and paratype did not permit verification.

# Appendix

## Station Data with Specimens Examined

(in chronological order)

### NORATLANTE, *Jean Charcot*

Sta 44; sample B-15; 26 Oct 1969; 44°07′18″N, 4°09′18″W to 44°06′36″N, 4°06′54″W; 1884–1911 m.
*Azygocypridina imperialis:* 1 instar I.

Sta 48; sample B-19; 31 Oct 1969; 47°28′06″N, 8°25′06″W to 47°29′36″N, 8°22′36″W; 2047–2149 m.
*Azygocypridina imperialis:* 1 adult male (USNM 193243).

Sta 48; sample E-16; 1 Nov 1969; 47°32′24″N; 8°30′54″W to 47°33′12″N, 8°31′30″W; 1970 m.
*Azygocypridina imperialis:* 1 ovigerous female, 1 instar I, 1 instar IV female (all 3: USNM 193244) + 1 instar V female (USNM 193241).

Sta 49; sample B-21; 1 Nov 1969; 47°42′06″N, 8°10′18″W to 47°42′18″N, 8°11′54″W; 1152–1200 m.
*Gigantocypris muelleri:* 1 specimen.

### BIOGAS I, R.V. *La Perle*

Sta Hors-Zone; sample DS-04; 5 Aug 1972; 47°42′54″N, 8°03′30″W; 1100 m.
*Paradoloria lippa:* 27 specimens including adults and juveniles.
*Philomedes lilljeborgii:* 8 specimens (USNM 193250).

Sta Hors-Zone; sample DS-05; 5 Aug 1972; 47°27′N, 8°22′54″W; 2210 m.
*Paradoloria lippa:* 1 female (USNM 157974) + 6 specimens.
*Metavargula quintuplex:* 2 females (USNM 193166) + 26 specimens.
*Philomedes pentathrix:* 1 juvenile.

Sta Hors-Zone; sample DS-06; 5 Aug 1972; 47°30′30″N, 8°18′W; 2090 m.
*Metavargula quintuplex:* 11 specimens.

Sta Hors-Zone; sample DS-07; 6 Aug 1972; 47°27′N, 8°18′W; 2170 m.
*Metavargula quintuplex:* 1 adult male + 9 specimens.

Sta Hors-Zone: sample DS-09; 7? Aug 1972; 47°30′12″N, 8°16′W; 2130 m.
*Azygocypridina imperialis:* 1 instar I.
*Metavargula quintuplex:* 125 specimens.
*Philomedes pentathrix:* 1 adult female (holotype) + 1 early instar.

Sta 1; sample DS-11; 8 Aug 1972; 47°35′30″N, 8°33′42″W; 2205 m.
*Metavargula quintuplex:* 5 specimens.
*Philomedes pentathrix:* 1 juvenile.

Sta 1; sample DS-12; 9 Aug 1972; 47°28′30″N, 8°35′30″W; 2180 m.
*Metavargula quintuplex:* 1 ovigerous female.
*Philomedes pentathrix:* 2 juveniles.

Sta 1; sample DS-13; 9 Aug 1972; 47°33′42″N, 8°39′54″W; 2165 m.
*Azygocypridina imperialis:* 1 adult female.
*Metavargula quintuplex:* 10 specimens.
*Philomedes pentathrix:* 1 ovigerous female (USNM 157976) + 30 specimens.
*Synasterope helix:* 1 adult female (holotype).

Sta Hors-Zone; sample DS-14; 10 Aug 1972; 47°39′N, 8°11′48″W; 1560 m.
*Paradoloria magna:* 1 specimen at same stage of development and sex as holotype + 7 earlier instars.
*Metavargula bilix:* 1 adult male (USNM 193279) + 1 instar I (USNM 158590).
*Metavargula* species indeterminate: 2 juveniles (193346).
*Philomedes pentathrix:* 1 specimen.
*Parasterope antyx:* 1 ovigerous female (holotype) + 2 ovigerous females (USNM 157977, 193252) + 1 A-1 male (USNM 193253) + 2 adult females + 1 A-1 female.

### POLYGAS, R.V. *Jean Charcot*

Sta 1; sample DS-15; 21 Oct 1972; 47°35′12″N, 8°40′06″W; 2246 m.
*Azygocypridina imperialis:* 1 early instar (USNM 193267).
*Metavargula quintuplex:* 129 specimens (USNM 193266).
*Philomedes pentathrix:* 290 specimens (USNM 193265).
*Domromeus heptathrix:* 8 specimens (UANM 193264).

Sta 1; sample DS-17; 22 Oct 1972; 47°32′N, 8°45′30″W; 2103 m.
*Metavargula quintuplex:* 18 specimens (USNM 193273).
*Philomedes pentathrix:* 384 specimens (USNM 193272).
*Domromeus heptathrix:* 2 ovigerous females (USNM 193274).

Sta 6; sample DS-25; 1 Nov 1972; 44°08′12″N, 4°15′42″W; 2096 m.
*Azygocypripridina imperialis:* 1 early instar (USNM 193270).
*Metavargula quintuplex:* 1 early instar (USNM 193271).

Sta 6; sample DS-26; 1 Nov 1972; 44°08′12″N, 4°15′W; 2076 m.
*Azygocypridina imperialis:* 1 early instar (USNM 193268).
*Metavargula quintuplex:* 40 specimens (USNM 193269).

### BIOGAS II, R.V. *Jean Charcot*

Sta 2; sample DS-31; 19 Apr 1973; 47°32′30″N, 9°04′12″W; 2813 m.
*Azygocypridina imperialis:* 1 adult female + 1 adult male (USNM 193238) + 1 instar II (USNM 193235) + 12 juveniles (instar I to IV).
*Metavargula quintuplex:* 1 adult male.
*Philomedes pentathrix:* 1 adult male (USNM 193190) + 4 adult males + 12 specimens.

Sta 1; sample DS-32; 19 Apr 1973; 47°32′12″N, 8°05′18″W; 2138 m.
*Metavargula quintuplex:* 1 ovigerous female (holotype) + 25 specimens.
*Philomedes pentathrix:* 1 adult male.
*Domromeus heptathrix:* 1 ovigerous female (USNM 157978).

Sta Hors-Zone; sample DS-33; 20 Apr 1973; 47°39′42″N, 8°05′30″W; 2338 m.
*Metavargula quintuplex:* 9 specimens.
*Philomedes pentathrix:* 1 juvenile.
*Domromeus heptathrix:* 1 adult female + 1 juvenile female.

Sta Hors-Zone; sample DS-34; 20 Apr 1973; 47°42′24″N, 8°03′24″W; 1031 m.
*Paradoloria lippa:* 1 ovigerous female (USNM 158584) + 14 specimens.
*Philomedes lilljeborgii:* 4 specimens and 1 adult female (USNM 157979) + 19 specimens.

### BIOGAS III, R.V. *Jean Charcot*

Sta 1; sample DS-35, 24 Aug 1973; 47°34′24″N, 8°40′42″W; 2226 m
*Metavargula quintuplex:* 1 adult male (USNM 193165) + 8 specimens.
*Philomedes pentathrix:* 14 specimens.

Sta 1; sample DS-36; 24 Aug 1973; 47°32′42″N, 8°36′30″W; 2147 m.
*Paradoloria lippa:* 1 ovigerous female (MNHN Os 133, holotype) + 1 adult male (USNM 193167A) + 4 adult males (USNM 193167B) +

7 adult males and 1 juvenile (USNM 193167C) + 224 specimens including adults and juveniles (some juveniles could be *Paradoloria magna*.

*Paradoloria magna:* 1 specimen (probably A-1 female), holotype.

*Metavargula bilix:* 1 ovigerous female (holotype) + 1 female (USNM 193278) + 1 female + 1 juvenile.

*Philomedes lilljeborgii:* 1 ovigerous female (USNM 193249) + 1 adult male (USNM 193247) + 2 adult females (USNM 193248) + 78 specimens.

*Synasterope phalanx:* 1 adult male (holotype) + 1 adult male (USNM 193261) + 1 adult male (USNM 193344).

Sta 1; sample DS-37; 24 Aug 1973; 47°31′48″N; 8°34′36″W; 2110 m.
*Metavargula quintuplex:* 35 specimens.
*Domremeus heptathrix:* 1 early instar.

Sta 1; sample DS-38; 25 Aug 1973; 47°32′30″N, 8°35′48″W; 2138 m.
*Metavargula quintuplex:* 15 specimens.
*Philomedes pentathrix:* 16 specimen.

Sta 2; sample DS-41; 26 Aug 1973; 47°28′18″N, 9°07′12″W; 3548 m.
*Metavargula quintuplex:* 6 specimens (1 with cyproniscid isopod).
*Parasterope styx:* 1 adult female (USNM 158585) + 1 adul t male (USNM 193255) with cyproniscid isopod.

Sta 5; sample DS-48; 31 Aug 1973; 44°29′N, 4°54′W, 4203 m.
*Metavargula hex:* 1 adult male.

Sta 6; sample DS-49; 1 Sep 1973; 44°05′54″N, 4°15′36″W; 1845 m.
*Metavargula quintuplex:* 8 specimens.
*Prionotoleberis rex:* 1 adult female (USNM 193260).

Sta 6; sample DS-50; 1 Sep 1973; 44°08′54″N, 4°15′54″W; 2124 m.
*Azygocypridina imperialis:* 1 instar I.
*Metavargula quintuplex:* 62 specimens.

## BIOGAS IV, R.V. *Jean Charcot*

Sta 6; sample DS-51; 18 Feb 1974; 44°11′18″N, 4°15′24″W; 2430 m.
*Azygocypridina imperialis:* 3 instar I.
*Synasterope helix:* 1 A-1 female.

Sta 6; sample DS-52; 18 Feb 1974; 44°06′18″N, 4°22′24″W; 2006 m.
*Azygocypridina imperialis:* 1 instar I.
*Metavargula quintuplex:* 168 specimens.
*Philomedes pentathrix:* 1 male.
*Tetragonodon pellax:* 3 adult females (USNM 158589, 158596, 159084) + 1 adult female.

Sta 6; sample CV-33; 18 Feb 1974; 44°04′36″N, 4°18′06″W; 1913 m.
*Gigantocypris muelleri:* 1 specimen.

Sta 5; sample DS-53; 19 Feb 1974; 44°30′24″N, 4°56′18″W; 4425 m.
*Rheina prex:* 1 juvenile + 1 early instar.

Sta 3; sample DS-55; 22 Feb 1974; 47°34′54″N, 9°40′54″W; 4125 m.
*Rheina prex:* 1 instar IV (USNM 193171).
*Synasterope hirpex:* 1 A-1 male.

Sta 2; sample DS-57; 23 Feb 1974; 47°30′48″N, 9°07′36″W; 2906 m.
*Azygocypridina imperialis:* 1 adult female.
*Synasterope index:* 1 juvenile male (holotype) with cyproniscid isopod.

Sta 2; sample Na-04; 23 Feb 1974; 47°32′N, 9°11′42″W; 2700 m.
*Azygocypridina imperialis:* 2 instar IV.

Sta 2; sample DS-59; 24 Feb 1974; 47°31′42″N, 9°06′12″W; 2790 m.
*Azygocypridina imperialis:* 1 instar I + 1 instar II (USNM 193236).
*Philomedes pentathrix:* 1 ovigerous female (USNM 158591) + 1 juvenile.

Sta 2; sample DS-60; 24 Feb 1974; 47°26′48″N, 9°07′12″W; 3742 m.
*Metavargula quintuplex:* 2 females.
*Hadacypridina biscayensis:* 1 ovigerous female (holotype).
*Parasterope styx:* 1 adult female (USNM 193254) with cryptoniscid isopod + 1 instar I.

Sta 2; sample CV-38; 24 Feb 1974; 47°30′54″N, 8°59′30″W; 2695 m.
*Azygocypridina imperialis:* 1 instar V (USNM 193242).

Sta 1; sample DS-61; 25 Feb 1974; 47°34′42″N, 8°38′48″W; 2250 m.
*Metavargula quintuplex:* 4 juveniles.
*Philomedes pentathrix:* 44 specimens.

Sta 1; sample KR-37; 25 Feb 1974; 47°33′48″N, 8°38′36″W; 2205 m.
*Philomedes pentathrix:* 1 juvenile.

Sta 1; sample CP-01; 25 Feb 1974; 47°34′36″N, 8°38′48″W; 2245 m.
*Metavargula quintuplex:* 1 specimen.

Sta 1; sample CP-02; 26 Feb 1974; 47°33′12″N, 8°41′24″W; 2177 m.
*Gigantocypris muelleri:* 1 specimen.

Sta 1; sample DS-62; 26 Feb 1974; 47°32′48″N, 8°40′W; 2175 m.
*Metavargula quintuplex:* 39 specimens.
*Philomedes pentathrix:* 11 specimens.

Sta 1; sample DS-63; 26 Feb 1974; 47°32′48″N, 8°35′W; 2126 m.
*Azygocypridina imperialis:* 1 adult male.
*Metavargula quintuplex:* 84 specimens.
*Philomedes pentathrix:* 2 specimens.
*Domremeus heptathrix:* 1 adult female.

Sta 1; sample DS-64; 26 Feb 1974; 47°29′12″N, 8°30′42″W; 2156 m.
*Metavargula quintuplex:* 21 specimens.

## BIOGAS V, R.V. *Cryos*

Sta 1; sample DS-65; 15 Jun 1974; 47°36′06″N, 8°40′30″W; 2360 m.
*Domremeus heptathrix:* 1 ovigerous female (USNM 193191).

Sta 2; sample DS-66; 16 Jun 1974; 47°28′12″N, 9°W; 3480.
*Metavargula* species indeterminate: 3 juveniles (USNM 193262).
*Philomedes pentathrix:* 2 specimens.
*Parasterope styx:* 1 A-1 female (with cyproniscid isopod).

Sta 4; sample DS-68; 19 Jun 1974; 46°26′42″N, 10°23′54″W; 4550 m.
*Hadacypridina biscayensis:* 1 juvenile.
*Synasterope hirpex:* 1 juvenile male (USNM 193258).

## BIOGAS VI, R.V. *Jean Charcot*

Sta 1; sample DS-71; 20 Oct 1974; 47°34′18″N, 8°33′48″W; 2194 m.
*Metavargula quintuplex:* 40 specimens.
*Philomedes pentathrix:* 1 specimen.

Sta 1; sample CP-08; 20 Oct 1974; 47°33′12″N, 8°38′30″W; 2177 m.
*Metavargula quintuplex:* 3 specimens.
*Philomedes pentathrix:* 3 specimens.

Sta 1; sample CP-08a; same station data as CP-08.
*Metavargula quintuplex:* 5 specimens.
*Philomedes pentathrix:* 1 specimen.

Sta 1; sample CP-09; 20 Oct 1974; 47°33′N, 8°44′06″W; 2171 m.
*Metavargula quintuplex:* 3 specimens.
*Philomedes pentathrix:* 51 specimens.

Sta 1; sample CP-09a; same station data as CP-09.
*Metavargula quintuplex:* 5 specimens.
*Philomedes pentathrix:* 64 specimens.

Sta 2; sample DS-73; 21 Oct 1974; 47°32′06″N, 9°06′W; 2805 m.
*Gigantocypris muelleri:* 1 specimen.
*Metavargula quintuplex:* 1 juvenile.
Cypridinidae (genus indeterminate): 1 larva.

Sta 2; sample DS-74; 21 Oct 1974; 47°33′N, 9°07′48″W; 2777 m.
*Azygocypridina imperialis:* 2 instar I.
*Philomedes pentathrix:* 1 specimen.

Sta 2; sample DS-75; 22 Oct 1974; 47°28′06″N, 9°07′48″W; 3250 m.
*Metavargula quintuplex:* 1 female.
*Hadacypridina biscayensis:* 1 adult female.
*Parasterope styx:* 1 A-1 female (with cyproniscid isopod).

Sta 2; sample CP-12; 22 Oct 1974; 47°32′30″N, 9°11′36″W; 2925 m.
*Gigantocypris muelleri:* 1 juvenile.

Sta 3; sample CP-13; 23 Oct 1974; 47°34′24″N, 9°38″W; 4134 m.
*Gigantocypris muelleri:* 2 specimen.
Sta 3; sample DS-76; 23 Oct 1974; 47°34′48″N, 9°33′18″W; 4228 m.
*Rheina prex:* 1 adult female (holotype) + 1 adult male (USNM 193170) + 4 juveniles.
*Metavargula* species indeterminate: 1 instar III (USNM 193263).
Sta 3; sample DS-77: 24 Oct 1974; 47°31′48″N, 9°34′36″W; 4240 m.
*Metavargula hex:* 1 female + 2 juveniles (USNM 193345).
Sta 4; sample DS-78; 25 Oct 1974; 46°31′12″N, 10°23′48″W; 4706 m.
*Synasterope hirpex:* 1 adult female (holotype) + 1 adult female (USNM 193256).
Sta 4; sample CP-15; 25 Oct 1974; 46°32′12″N, 10°28′30″W; 4715 m.
*Gigantocypris muelleri:* 1 specimen.
Sta 4; sample CP-16a; 25 Oct 1974; 46°27′18″N, 10°25′48″W; 4825 m.
*Rheina prex:* 1 juvenile.
Sta 4; sample CP-17; 26 Oct 1974; 46°30′48″N, 10°19′30″W; 4706 m.
*Gigantocypris muelleri:* 2 specimens.
*Philomedes* species indeterminate: 1 A-1 male (USNM 193251).
Sta 4; sample CP-18; 26 Oct 1974; 46°30′30″N, 10°26″W; 4721 m.
*Gigantocypris muelleri:* 1 specimen.
Sta 4; sample DS-79; 26 Oct 1974; 46°30′24″N, 10°27′06″W; 4715 m.
*Gigantocypris muelleri:* 1 specimen.
*Rheina prex:* 1 juvenile.
*Synasterope hirpex:* 1 adult male (USNM 193257).
Sta 5; sample CP-21; 30 Oct 1974; 44°21′12″N, 4°49′18″W; 4453 m.
*Gigantocypris muelleri:* 1 juvenile.
Sta 5; sample CP-21a; same station data as CP-21.
*Gigantocypris muelleri:* 1 juvenile.
Sta 5; sample CP-22; 30 Oct 1974; 44°22′54″N, 4°54′48″W; 4475 m.
*Gigantocypris muelleri:* 1 female with unextruded eggs.
Sta 6; sample CP-23a; 31 Oct 1974; 44°04′36″N, 4°21′24″W; 1980 m.
*Metavargula quintuplex:* 106 specimens (1 with cryptoniscid isopod).
*Tetragonodon pellax:* 1 adult female (holotype) + 1 adult male (USNM 159085) + 4 adult males + 6 adult females + 2 juveniles.
*Domromeus heptathrix:* 2 adult females (1 with choniostomatid copepod).
Sta 6; sample CP-24; 31 Oct 1974; 44°08′06″N, 4°16′12″W; 1995 m.
*Metavargula quintuplex:* 2 specimens.
Sta 6; sample CP-24a; same station data as CP-24.
*Metavargula quintuplex:* 36 specimens.
Sta 6; sample Nasca-05; 31 Oct 1974; 44°07′12″N, 4°17′18″W; 1980 m.
*Metavargula quintuplex:* 1 adult male (USNM 158592A) + 82 specimens (USNM 158592B).
Sta 6; sample DS-87; 1 Nov 1974; 44°05′12″N, 4°19′24″W; 1913 m.
*Azygocypridina imperialis:* 1 ovigerous female (USNM 193237) + 1 instar I + 1 instar I (USNM 193234).
*Metavargula quintuplex:* 111 specimens.
*Philomedes pentathrix:* 1 specimen.
*Prionotoleberis rex:* 1 adult female (holotype).
Sta 6; sample DS-88; 1 Nov 1974; 44°05′12″N, 4°15′42″W, 1894 m.
*Metavargula quintuplex:* 1 specimen.

## BIOGAS VII, R.V. *Cryos*

Sta 2; sample CP-28; 19 Jul 1978; 47°29′30″N, 9°03′30″W; 3380 m.
*Gigantocypris muelleri:* 1 specimen.
Sta 2; sample NA-20; 19 Jul 1978; 47°32′00″N, 8°56′00″W; 2700 m.
*Azygocypridina imperialis:* 1 instar III.
Sta Grande Vasiere; sample KR-128; 24 Jul 1978; 47°40′54″N, 4°20′18″W; 101 m.
*Prionotoleberis pax:* 1 ovigerous female (USNM 158593).
Sta Grande Vasiere; sample KR-131; same station data as KR-128.
*Prionotoleberis pax:* 1 ovigerous female.
Sta Grande Vasiere; sample KR-137; same station data as KR-128.
*Prionotoleberis pax:* 1 early instar.

## BIOGAS VIII, R.V. *Le Noroit*

Sta 1; sample KG-144; 26 May 1979; 47°34′12″N, 8°40′18″W; 2225 m.
*Philomedes pentathrix:* 1 juvenile.
Sta 1; sample KG-145; 31 May 1979; 47°32′51″N, 8°39′30″W; 2170 m.
*Philomedes pentathrix:* 1 instar II.
Sta 1; sample KG-147; 31 May 1979; 47°33′24″N, 8°40′42″W; 2190 m.
*Domromeus heptathrix:* 1 ovigerous female (holotype).
Sta 1; sample KG-148; 1 Jun 1979; 47°33′30″N, 8°40′18″W; 2170 m.
*Metavargula quintuplex:* 3 early instars.
*Philomedes pentathrix:* 1 adult female (USNM 193007) + 3 juveniles.
Sta 1; sample KG-149; 1 Jun 1979; 47°32′36″N, 8°39′06″W; 2165 m.
*Philomedes pentathrix:* 1 juvenile.
Sta 1; sample KG-151; 2 Jun 1979; 47°33′57″N, 8°39′09″W; 2205 m.
*Azygocypridina imperialis:* 1 ovigerous female.
Sta 1; sample KG-156; 4 Jun 1979; 47°33′48″N, 8°39′39″W; 2207 m.
*Philomedes pentathrix:* 2 juveniles.
Sta 1; sample KG-157; 4 Jun 1979; 47°34′21″N, 8°39′45″W; 2227 m.
*Philomedes pentathrix:* 1 adult female (USNM 193006) + 3 juveniles.
Sta 1; sample KG-158; 4 Jun 1979; 47°32′48″N, 8°39′39″W; 2167 m.
*Metavargula quintuplex:* 1 specimen.
*Philomedes pentathrix:* 1 ovigerous female (USNM 193005).

## BIOGAS IX, R.V. *Capricorne*

Sta 1; sample CP-32; 13 May 1980; 47°30′23.4″N, 8°32′15″W to 47°28′16.8″N, 8°29′41.4″W; 2170 m.
*Gigantocypris muelleri:* 2 specimens (USNM 193245).
Sta 1; sample CP-33; 13 May 1980; 47°32′52.2″N, 8°37′36.6″W to 47°34′48″N, 8°39′37.2″W; 2115 m.
*Gigantocypris muelleri:* 2 specimens.
Sta 1; sample CP-34; 14 May 1980; 47°31′43.8″N, 8°23′18″W to 47°33′51.6″N, 8°26′38.4″W; 1970 m.
*Gigantocypris muelleri:* 1 specimen.
*Metavargula quintuplex:* 1 female (USNM 157975) + 11 specimens.
Sta 2; sample KG-172; 16 May 1980; 47°32′04.8″N, 9°05′46.2″W; 2820 m.
*Azygocypridina imperialis:* 1 adult female.
Sta 2; sample KG-173; 16 May 1980; 47°31′34.2″N, 9°04′13.2″W; 2740 m.
*Azygocypridina imperialis:* 1 instar IV (USNM 193240).
Sta 2; sample KG-176; 17 May 1980; 47°31′33″N, 9°05′45″W; 2807 m.
*Azygocypridina imperialis:* 1 instar III (USNM 193239).
Sta 2; sample KG-178; 18 May 1980; 47°32′04.2″N, 9°05′10.8″W; 2770 m.
*Azygocypridina imperialis:* 1 instar III + 1 instar IV.
Sta 2; sample KG-180; 18 May 1980; 47°32′03″N, 9°05′58.2″W; 2847 m.
*Philomedes pentathrix:* 1 instar (identification questionable).
Sta 2; sample KG-185; 19 May 1980; 47°31′58.2″N, 9°06′16.2W; 2828 m.
*Azygocypridina imperialis:* 1 adult female.

## BIOGAS XI, R.V. *Jean Charcot*

Sta 1; sample CP-37; 11 Oct 1981; 47°33′48″N, 8°39′12″W to 47°34′16.2″N, 8°41′30″W; 2175 m.
*Metavargula quintuplex:* 7 specimens.
*Philomedes pentathrix:* 1 adult female + 1 juvenile with cryptoniscid isopod + 1 juvenile.

## BIOCYAN, R.V. *Suroit*, submersible *Cyano*

Sta 1; sample PL-18; 26 Jun 1983; 47°32′03″N, 8°27′33″W; 2000 m.
*Metavargula quintuplex:* 1 juvenile (USNM 193276).
Sta 1: sample PL-22; 1 Jul 1983; 47°31′32″N, 8°27′30″W; 2000 m.
*Metavargula quintuplex:* 1 specimen (USNM 193277).
*Domromeus heptathrix:* 1 ovigerous female (USNM 193275).

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**Synonymy** in zoology must use the short form (taxon, author, year:page), with full reference at the end of the paper under "Literature Cited." For botany, the long form (taxon, author, abbreviated journal or book title, volume, page, year, with no reference in "Literature Cited") is optional.

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